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Keywords: child sexual abuse; disclosure; social support; self-esteem

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EDITORIAL

The Third Symposium on Naval Medicine was held at the Royal College of Physicians, Regent Park, London on the 24th and 25th of November 1973 by kind permission of the President Dr C. A. Clarke CBE.

The theme of the Symposium was 'The opium in stress as a Naval Environment' and it was attended by nearly 100 people representing all aspects of medical opinion and service life.

Papers reached a high standard and were of such general importance to all medical officers that they have been gathered together and appear in this issue of 'The Journal' as a unique collection covering a wide spectrum of disciplines in the growing field of maritime medicine. In particular, the fascinating talk given by the only visiting guest speaker Rear Admiral Charles Wade MC, RMC is reproduced exactly as delivered and provides an extremely interesting and vivid account of military medicine

under conditions which many may find, indeed do expect. All medical officers will find Admiral Wade's talk as full of our 'similarity value'.

As was stated by the Medical Director General (Navy) in his introductory letter to the Symposium programme:

No man, soldier or seaman is ever completely passive or stress free. The Royal Navy with every form of stress that most attempts to remain robust, flexible, because of the pressures it exerts on the core of its personnel and their families and to the wide research interests it promotes.

The need of the Royal Navy for highly trained research oriented medical officers who are experts in the specialisation of maritime medicine has never been greater and it is hoped that members of 'The Journal' will stimulate the interest of all medical officers in the vital importance of these subjects to the Royal Navy of today.

THIRD SYMPOSIUM ON NAVAL MEDICINE
ROYAL COLLEGE OF PHYSICIANS, LONDON,
NOVEMBER 8 and 9, 1973

Before the formal opening of the Third Symposium on Naval Medicine, the Medical Director General (Naval) Surgeon Vice Admiral James West expressed his gratitude to the President of the Royal College of Physicians, Dr C. A. Clarke and his staff, for their kindness in offering the excellent facilities of the College. He also thanked the Librarian, Mr L. P. Foyes, who provided the exhibits on 'Naval Surgeon Natuschew' in the Library, and Mr L. B. Perkins, Mr A. C. Ellis and Mr A. R. Colburn of the Technical Illustrations Pool for the design and execution of the scientific exhibits and the preparation of slides.

He welcomed the official guests in particular the Under Secretary of State for Defence for the Royal Navy, Mr Anthony Burt, the Commissioner General Royal Marines, Sir Ian Conway and other senior officers including the Chief Surgeon, Mr R. W. Lythall and members of his staff. By their presence, they underlined the importance of close collaboration in the scientific

field in which the Royal Naval Medical Service was now commencing an increasing proportion of its personnel and resources. Other guests who were welcomed included representatives of the British Service, the Royal Colleges, Universities, Research and Research Councils, and also representatives of the medical departments of NATO and European Nations. He was particularly glad that two medical officers of the United States Navy would be participating in the symposium.

Finally, he requested his great pleasure in introducing the Chief of Naval Personnel and Second Sea Lord, Admiral Sir Derek Engson and asked him to open the symposium. It was Admiral Engson's great interest and concern, not only with the sailor and his environment but also with the family behind the sailor, that had encouraged the Royal Naval Medical Service to extend its medical care of the naval family.

INTRODUCTION BY ADMIRAL SIR DEREK EMPSON, CHIEF OF NAVAL PERSONNEL AND SECOND SEA LORD

I should like first of all to echo very warmly and warmly James Watt's welcome to all of you to this symposium and to say that having listened to the list of eminent people who are here with us to day there can be no doubt that the symposium will be a success. One of the privileges of my appointment as the Second Sea Lord that I particularly value is the rapid advancement of the Naval Medical Service. I think some of you might think it strange or even dangerous that a layman should be charged with the overseeing of such a specialised organisation and so I hasten to reassure you that I see my role as being that of a benevolent active supporter with the advantage of being able at first hand to throw a lay pebble into the professional pond to see what ripples emerge. Although I don't want this to become a mutual admiration society in any way, I am sure that as Second Sea Lord has ever been lucky with his Medical Director General. Sir James Watt not only accepts their activities but he even encourages them.

I have watched from the side lines and experienced to a happy end, extend the development of Naval Medicine for over 30 years. The development has been dynamic but I do not think that there has ever been more rapid and significant progress at any time in the history of the Service than is taking place now. This is just as well because the pressure and the pace of life in the Navy has also been subject to striking changes most of which have occurred rather than decreed the tendency to stress. I believe it is entirely appropriate that stress has been chosen as the theme for this symposium because the reduction and the possible prevention of stress and

the response to it are of greatest importance to us in the Navy — greater I suggest than to any other Service or almost any other community. I am sure you will forgive me if I point out in debate of the statement that the Navy is unique in many respects. We alone, I believe, operate in two different environments, on the one under the sea, on the air and on land. We stress response voluntarily but increasingly I see short, long periods of seclusion on our submarines and their families. We alone require men at sea to live continuously inside their weapons system rather as if the soldier had to live in his tank and the aviator in his aircraft. What is more ships now spend much more of their time at sea than they used to — more than eight times as much as before the last war both on the surface and beneath it. Aircraft performance has exploded upon its weapons and detection devices have become much more sensitive and complex and all these are ingredients of stress. Even at Whitehall we find stress and I say that with some feeling as the staffs of all the Services seem to keep pace with the changes dictated generally at short notice, by political or financial considerations. We find stress too in the homes of our officers and men largely because of the separation I mentioned and also the very young age at which they get married. So I must see the prevention of stress and the study of its causes as all environments as one of the bigger challenges that our Naval Medical Service faces. I am confident that this challenge will be met and I firmly believe that in the Navy of today we are developing standards of maintenance which are worthy of our Service and of a Nation which has a far

unpublished wartime history and must have a significant future if it is going to survive.

I won't suppose my further story on you or on myself and I will give way now to the speakers you have really come to hear

because, as the incomparable Truman Tins has said, "I don't have a psychical. I don't want one for the simple reason that I've learned to me for long enough to might become disturbed."

SHIPWRECK AND SURVIVAL

by Frank Gellies

Introduction

The environmental element linking on the shipwreck survivor may be such that his immediate welfare will be enhanced in the full and at times completely overwhelmed. The survival of the individual in these circumstances depends to a large extent on the specific survival equipment he is provided with and the training he has received in its use. The Naval Medical Officer, with his specialized knowledge of the aspect of marine environmental medicine plays a vital role in the education of naval personnel on this subject and in the development of this equipment.

The importance of this topic may be judged by the statistics from World War II when it was found that approximately two thirds of all Royal Naval fatalities (as recorded) can directly from the causes sustained during the enemy action, but from a failure to survive the environmental consequences of the post shipwreck phase (Tidball, 1944). Since the Second World War the Royal Naval Personnel Research Committee, at the instigation of the Admiralty Branch of the Royal Navy, working in close liaison with the Royal Naval Life Saving Committee have been instrumental in advancing co-ordinated in the testing of new items of survival equipment which have come into service since the war.

This paper examines some of the most important aspects of survival as far as in order to determine where the major problem areas must today since the introduction of the most sophisticated life saving equipment.

Cause of death following shipwreck

In order to establish where the problem areas lie it is obviously necessary to try and determine the cause of death of those who die following shipwreck and in what phase of the shipwreck subsequent survival against death occurs.

- (a) *Initial location.* A victim present age was likely to die in the disaster which actually caused the accident eg. collision, fire explosion etc. but there is ample evidence to show that in the past this accounting for only a very small percentage of the total dead (Tidball 1944; McCann, Goughy, Corbett and Widdowson 1954). Whether or not this will hold true in a future made type action is difficult to predict in the moment but it is possible with modern ship designs and personnel training in damage control many more lives will have to be sustained before the abandon ship order is given and therefore study must therefore be likely in this phase.

- (b) *Post abandonment/Pre Rescue.* By far the greatest number of fatalities have occurred in the phase between abandonment ship and rescue. Post abandonment lead on to unexpected drowning at the major cause of death in these circumstances. Although drowning is likely to be the terminal event, the reason why they drown is not so obvious. Certainly the provision of adequate flotation aids does not tend to reduce their number.

been drastically cut the much quoted Tolson incident showed (Steinley 1942). Similarly during the Second World War there were sufficient human problems in the form of Corley blazes and forest fires for the shipwreck survivors of Royal Navy ships yet over 30,000 died during that phase of survival.

The post war studies of merchant shipwreck losses during World War II, by MacLean (1946) in America and by McCance *et al.* (1946) in the country, leave little doubt that cold presents the major problem to the shipwreck survivors, but in comparison to a raft or in a life boat Kierulff's (1963) account of the *Edinburgh* sailing reveals that hypothermia is a problem to commercial survivors even in sub-tropical waters (17°C).

The question arises as to whether the present affordable lifeboat provides the necessary thermal protection to protect the shipwreck survivor today. Experimental work by Glaser and McCance (1938) in Tromsø and more recently by the Royal Danish Navy off Greenland (Vatgaard 1972) and by the United States Air Force off Alaska (Wright 1972) all demonstrated that reliable lifeboats appeared to be the ultimate solution to the problem of protection against cold for the survivor at sea. However, there is a markedly an ethical limitation on such field trials and one is obliged to study actual incidents in order to determine if these experimental findings are borne out in the most severe survival conditions encountered in real disaster.

Regrettably no recent survey of survival at sea incidents has been published, so one is dependent on newspaper accounts for information. These undeniably high lights the survival of human interest which are more likely to appeal to these readers. These sources tend to get depressure/survival coverage leaving the casual reader with an

already biased opinion. Thus the recent accounts of the Robinson family (Robinson 1973) and the Bishop husband and wife team (Bishop and Bishop, 1966) who survived for periods of 34 and 117 days respectively in the Pacific in 1973 tend to create a false impression that the only realising problem with lifeboats is one of provision of adequate drinking water and food. On closer analysis of these two incidents one feels that they occurred in an area of the world between the Galapagos Islands and Central America where the sea temperature is exceptionally high (25-26°C) and where the rainfall is heavy. Thus the climatic conditions favoured a long survival episode.

But what about the experience of the users of these rafts in other sea areas, the part aspects of which are less favourable to survivors? When one looks at the details of some of these incidents, it is apparent that cold is still a major problem. Not necessarily because the rafts have proved sufficient in thermal insulation but more likely because the occupants did not apparently know how to use them correctly. For example in the *Indefatigable* incident (Fugh 1963) the openings of the raft were apparently not correctly secured; it leaked at all. As a result the inside of the raft was quickly flooded by a breaking wave and the seaward side worked overboard. Two of the three occupants subsequently died from hypothermia. More recently (Kilham, 1972) five bodies from the Greek cargo ship *Gold Cross* were found on the water surface at an estimated 14,000 m in the English Channel off Dover. Although the ultimate cause of death in these five individuals was given as drowning there were little doubt that this was as a consequence of hypothermia. These unfortunate men were either unable to right the upturned raft because of lack of knowledge, or unaware of the importance of doing so. It is of course, also possible



FIGURE 1
Awa Maru, the Japanese ship,
transporting the 1st Division, Australia
1942

that they may have negatively affected the ash which continued to swell, before finally surrendering with exhaustion and waiting for rescue boats.

In September 1944 the Norwegian Car Ferry *Sjogrensk* sank in a storm off Denmark (Table 1).

All 67 of the crew and the 91 passengers (including 50 children) managed to abandon ship safely. All with one exception were not negatively affected alive. The last survivor was found to have died from a spontaneous infarct (Hansen, 1974). Page 2 shows some variations on the underwire as an irreversible identifiable identifiable warning record.

Had the *U-boat* the *Force* not captured some long range B-41A, *Seismic* *Force* *Helicopters* shortly before the incident occurred it is probable that these people would have died from hypothermia in the sea, rather than in the ship.

In March 1972 one survivor and one

dead body were rescued from a *U-boat* from the Japanese ship *Awa Maru*. The survivors remained from two others that were washed overboard from the ship. This suggests that possibly the ash was diverted into another dead body was recovered from another ship from the same ship.

A Russian report on the sinking of a tug in the Arctic (Klimovskiy, 1942) gives the thermal pressure problem of ash, ash, ash, although it would appear likely from this report that the survivors must have been well insulated with personal clothing, as the report describes how the fresh water was frozen in the sea. This indicates extremely low external ambient temperatures in the sea.

In November 1973 the survivors of the *U-boat* that sank in a storm off South Australia spent one day in a *U-boat* before being washed ashore in a *U-boat* part of *U-boat* One was dead



FIGURE 1
 Sikorski HO4S helicopter, 1944-45
 (a) Sikorski HO4S helicopter
 (b) Sikorski HO4S helicopter
 (c) Sikorski HO4S helicopter
 (d) Sikorski HO4S helicopter

from hypothermia, while in the rats, while two others died from hypothermia while awaiting rescue efforts.

From these few examples and there is reason to suspect that the introduction into service of the inflatable bladders has not solved the major thermal environmental problem. It would appear that a serious education in its use and on the subject of survival at sea in general is urgently required. It could also be concluded that further research and development is required to make these aids more stable and operable to the individual with the minimum of training, or preferably without any special training.

See Death after Rescue. Finally a survey percentage for other reasons from the sea, both from the delayed effects of drowning and during the recovery phase from hypothermia. Although overall these amount to only a very small percentage of the total dead, they constitute an important percentage from a medical standpoint i.e. having reached a safe refuge alive, it should be possible to treat them and keep them alive.

The question arises as to the relative importance of drowning or hypothermia in the cause of these deaths in the final event, for one condition may prove harmful for the other (Kirklin 1970a). The magnitude of this problem is difficult to evaluate but a literature search gives some indication of its magnitude.

In 1875, Rankin, a police surgeon at Hamburg, recorded cases of sailors who had fallen over the quays and harbours of Hamburg being rescued alive and dying within 24 hours. He recorded rectal temperatures of 24.4, 25 and 26.4°C in some of these, although he did have two cases with rectal temperatures of 34 and 36°C who survived. Fifty years previously, Sir

John Franklin (1846) in his biography of the great naval surgeon explores the John Richardson collapsed and became unconscious after having been rescued from the Copper Mine area while attempting to cross across it for an alternate route. Although Richardson did not die on that occasion, the post-rescue collapse following cold water immersion has a bearing on the problem under discussion.

During the Second World War both the Germans and the Allies became aware that other means from cold water some of those rescued were subsequently died shortly after rescue. This fact became apparent to the Germans during the Normandy campaign when Max Muehlen (1945) reported late finished sailors who had been immersed in the sea for a short period although fully conscious and waking in their own rooms, became unconscious shortly after rescue. Similarly, Gross-Wiedhoff (1944) reports how most finished alive from Normandy waters subsequently died from the impact of hypothermia.

It was these and subsequent similar incidents to "dashed" survivors during the Battle of Britain that were the supposed justification for the subsequent British requirement in these experiments reported by Alexander (1945) some of those removed from the cold water while still alive, died shortly afterwards usually within a 30 minute period.

On the Allies side Warham (1947) cites two cases reported by Maier and Schenck of two aviators dying seven and nine hours following periods of 45 and 100 minute immersion in the North Sea. Elements on the rescue both had recovered in unexpected order of Admiralty instructions presumably to end their ordeal.

McCauley *et al* (1976) found that 17 per cent of three sheepskin coverings exposed their water at 16° or less died within 24 hours of rescue while none of the 113

remained there until dawn. "D.C." died. His Donald Chesley (1944) accounts how of 15 men who spent 30 minutes in water at -17°C were dead immediately after rescue.

In The Battle of the Falkland Islands during the First World War it is reported (Goodland, 1965) that the majority of the 780 survivors of the German battle cruiser *Goeben* died on board one of the RN ships that rescued them and following the sinking of the *Goeben* in 1913 some survivors died on board the fishing boats which had rescued them before they could be taken ashore (Hocking and Hocking, 1977).

A classic example is cited by Lee and Lee (1971) who quote the words of Captain H. J. M. Dewar of the SS *Empire Winard* sunk while on Arctic survey. "Everyone was conscious when taken out of the water but many lost consciousness when taken into the warmth of the turrets. Nine died soon after being rescued..."

Kassapa (1961) reporting on the sinking of the *Lafayette* reports how of the 12 recovered dead by the *Wendell* the first marine ship on the scene, it was believed that most were alive at rescue. The sea temperature was $17^{\circ}\text{F}^{\circ}\text{C}$. He estimated that of the 128 deaths resulting from that accident, 115 died from the effects of hypothermia.

When the New Zealand Island Ferry *Waharoa* sank in Wellington Harbour in 1937 31 people lost their lives. Murray (1960) believed that at least 12 were alive on rescue but died shortly after.

Calden (1972a) reported a case of a young boy diving from hypothermia 40 minutes after immersion in hospital following a period of immersion in cold water in the English Channel in July.

MacMally in History of the Medical Services in War (1945) stated "In our numerous features observed in other waters as well as the Arctic was that many did even who had managed to get themselves

in the point of being found that they collapsed when being towed when rescued appeared to be landed on the same manner as those who had been helped while still in the water."

Thus a problem undoubtedly exists in attempting to as precisely difficult to make out. This is particularly so since there are no known specific identifiable post mortem features from death due to hypothermia. It would appear that the best task for some reason, probably somnolent fibrillation. The finding of secondary urinary crystals on routine postmortem provides the coroner's pathologist who is looking for an explanation of sudden death with an explanation of cardiac arrest with a ready answer. Evidence such as MacMally's suggests that there is at least a possibility that death is the cause or post mortem process may be much more important than his father's been approached and there is similarly a possibility that hypothermia may be the prime factor.

Other Problems in Survival in Sea

Other medical problems in survival at sea such as dehydration, starvation, sea sickness, shock and other natural and man made dermatological conditions as well as the important psychological problems have not been mentioned in the brief paper as it is considered that all play a very secondary role compared to the problems of the most profound, and all are well covered elsewhere (Harvey, 1948; Michael, 1960; Brown, Condon, and Aslett, 1968; Ballantine and Beutelschick, 1965).

Conclusions

From the sparse evidence available it is difficult to draw any firm conclusions but it would appear that:

- (i) Cold is still the major problem confronting the survivor at sea.
- (ii) The current scientific attitude may

NOTES ON SURVIVAL AT SEA

by Frank Collier

The following notes should be taken as a reminder of some of the more basic principles of survival but not as a comprehensive work on the subject.

1 **Position of Survival.** In any survival situation, be it shore or afloat, the most important action for the survivor to take is to safeguard against the most immediate threat to his life. Having achieved this, then consider the next greatest threat, and protect himself against that, and so on until a sequence of priorities is established. With-out such a planned sequence, only the lucky will survive. First and foremost, protect against the hazards of the environment before starting to worry about the various uses of, for example, shelter flames. Thus it follows that protection has a higher priority than food and so one can survive many days without water and weeks or more food but protection and location have a higher priority than food and water.

The Table outlines actions to be taken in order of importance for a survival at sea situation.

2 **Raft Capture.** Fully laden rafts are unreliable in capture but may do so if fully partially laden. If there is a likelihood of the raft capturing, everyone should don their life-preservers which there should be fully inflated if the raft captures, do not panic if well first upends down and points the occupants to escape through either

exitways. The raft should then be righted and schobered. Righting the capsized raft is accomplished easily by one man with covering himself DOWN WIND of the raft and climbing on to the under surface. With feet on the CO cylinder and with hands grasping the handline, keep leaning his body backwards.

3 **Cold Exposure.** To the shipwrecked survivor the greatest immediate threat to life is drowning. Having safeguarded against this by using a life-preserver and if possible the next problem is cold exposure. Wearing as much clothing as possible and using the blanket as designed, will protect the survivor from exposure even in the Arctic.

Always remember that the chance of being rescued within 74 hours is high even so attention to the simple principles outlined above will ensure survival for much longer periods if required.

Editor's footnote

During the course of the Third Symposium on Basic Research a booklet was prepared at the conference which contained a summary of the foregoing article as the basis of *Survival at Sea*. This booklet proved extremely popular and is therefore published again for the benefit of those who were not at the conference or who were unable to obtain a copy.

TABLE
EFFECTS OF CHRONIC EXPOSURE TO 100 PPM POLYCHLORINATED BIPHENYLS ON REPRODUCTIVE AND DEVELOPMENTAL PARAMETERS

100

[illegible]

CHALLENGE OF THE ARCTIC

by A. F. Duvikhan and W. J. Hicks

In the past the Arctic was considered to be a mysterious and hostile area only as touched by a few lonely miners and venturers and by explorers who were prepared to face and combat the elements. Since World War II, there has been an ever increasing awareness of the strategic and economic significance of the Arctic, and there is every indication that from now on the northern latitudes will receive even more attention.

Today there are three thriving Arctic cities in Norway and Sweden alone. We can fly to Tromsø 200 miles inside the Arctic circle within four hours, meet our modern centrally heated buildings, various conveniences for a few hours in a new and finally return to the country convinced that there are no longer any great problems in living in the Arctic latitudes.

However, what of the individual who is suddenly transported to the Arctic and is forced to live and work in the extreme cold without benefit of modern urban facilities? What problems does he have to face? Do we as Lat. men have to adopt the right attitude and not let equipment be to his detriment? Could he survive as an emergency only?

Since 1949 the Royal Naval Comantank squadrons have been operating helicopters in Northern Norway as part of the special training for those squadrons committed to the defence of the Northern Fleet of NATO. This paper summarizes some of the problems encountered during the winter training periods, together with their effects on the individual and methods presently employed in training that aim to cope with survival problems.

Arctic Regions

One commonly refers to the Arctic as the area north of the Arctic circle, but the point will arise that in many instances climatic conditions are not greatly different from many areas further south. For the purpose of this paper the Arctic regions are considered as those regions to the beyond the limits of the tree line which during the coldest months the mean temperature is below 4°C . There are in the main three late and barren regions although small trees may still grow in sheltered valleys.

Climate

Winter in northern Norway lasts from October to April and temperatures can be expected to fluctuate from $+5^{\circ}\text{C}$ to -32°C .

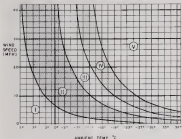
FIGURE 1. TEMPERATURE



Fig. 1. Maximum and minimum temperature over 24 hours during the winter months (24th to 30th March 1955).

(Fig. 1) One of the most striking features being the sharp rise and fall of temperatures encountered. Variations of up to 30°C in a 12 hour period are not uncommon. Occasionally temperatures rise to $+5^{\circ}\text{C}$, especially at coastal areas, bringing out snow and increasing rain.

Winds are generally light but wind speeds of up to 60 knots have been recorded.



- ① Consistent with average ground water
- ② Very cold: local increases permissible to limited depth
- ③ Slightly cold: small increases considerable near to other nearby dips
- ④ Exposed of bottom: fresh layers depending on topography of vicinity, amount of water infiltration, and character of soil and vegetation. Frost and ice in temporary water increases deepening
- ⑤ No water effects are required. Exposed fresh soil areas or low areas are required

Fig. 2

early good at times the area becomes more and more usable. When not actually working they are in a rest status. Recreational facilities are of necessity limited and are used in seasons based. This is especially so when there are working in the field and having other means with seasonal facilities. The fact that they know that they will only be subjected to these conditions for a few

hot periods before returning home, school, work and a few other main services and the increasing of up indoor ideas also help to alleviate this problem.

Working Conditions

The handling of animals in the Arctic is a special problem. The maximum must be fully protected from the possibility of

fast upstage on to either his clothing or hands, the former requiring the assistance provided by the clothing and the latter requiring various tools/eggers. In this case the man must catch parasites and gloves which are impervious to petrol and solvents. All these factors add to the time taken to service the machine. In addition the exposure to severe cold and the potential of frozen man may well lead to mechanical breakdowns and associated more frequent servicing. This in itself can adversely affect the man's morale.

Flying Operations

The service has other but equally important problems when flying in the Arctic.

1. *Unclashed Flies*

Due to the necessary low level flight profile, unclashed worms, strong to insect balls as large as up to 500 ft are a hazard to the aircraft and crew.

2. *Incidence of Failure*

There is also a risk of mechanical failure of the aircraft, or bad weather conditions forcing the pilot to make an emergency landing, placing crew and passengers in a survival situation which may well be the crucial step. In such circumstances clear to come an immediate and important problem which may well be further complicated because of injury or ill-manoeuvre decisions. Except in the case of crew incidents where the helicopter is likely to be heavily equipped, crews are advised to build their own shelter. This takes time and therefore some form of rescue shelter must be provided on the immediate survival pack. At the present time this is in the form of a double layer tent, but again continuing research on this aspect is required. Tarpaulins and whatever else further towards but they will not be discussed in this paper.

Survival

Both the mariners and the aviators may obviously, understandably be concerned about their chances of survival in any given emergency situation.

Russell Goodall has summarized it all up rather nicely as follows:

The mental attitude of the man whose business it is to operate survival through the broken sky over thick wastes of Arctic snow and ice is substantially affected by their recognition of the cold and darkness as factors influencing their chances of survival in case of crash or bail out. This attitude is present from the moment the message is passed or affects their preparation, it is reflected in the abundance of survival gear and vehicle survival."

He was of course referring to aviators in particular but much of what he has said also holds true for the groundcrew whose task it is to maintain the aircraft in the field. To encourage the men to adopt the right attitude we consider it is necessary for all personnel to undertake a period of pre-Arctic training during which time they can be briefed adequately on the problems to be faced and how best to combat them.

This must be followed at an early stage by practical Arctic survival training. Practical survival training in the Fleet Air Arm has always been considered not only as an essential aid to teaching survival techniques but also as a useful training ground for new and up-to-date survival aids.

What is northern Norway all personnel are required to undertake a period of survival training which is carried out under the direction of the Army Medical Survival Team. This is now recognized as an essential part of the Arctic training for Commando Air Squadrons thus ensuring that all personnel involved receive adequate education in survival and rescue techniques. During the three days that the students are living in the field in a snow bound survival situation they are given the

opportunity to acquaint themselves with the survival aids which are stored in the survival shed at the same time to gain first-hand experience of many of the problems created by the climate and terrain.

Students are given a brief on the uses of the survival aid and are updated on the weather forecast before being taken to the survival area. They are then allocated about two hours in which to construct a temporary shelter before it is completely dark. Food and drink are prepared from the survival ration and each team is encouraged to improve items which add to their comfort. During the second day the students are taken on a short snow trek to impress upon them the need for physical fitness and the adjustments in clothing which are required whilst exercising. Later that day each group builds temporary aids and sets various types of traps and snares. The third day is taken up with a physical

exercise involving load carrying and ice fishing when practicable. Subsequently all the teams meet to discuss their experiences in relationship to what they were taught during the pre-Arctic training.

We believe that the training method above has proved extremely beneficial and has done much to dispel the subconscious fear which some individuals have of the Arctic. It also provides a most useful forum for original ideas and an opportunity for the testing of new survival aids. It is our opinion that full advantage should be taken in the future of this opportunity to study further basic medical problems associated with Arctic survival.

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THE PREDICTION OF IMMINENT HEAT COLLAPSE IN EXTREMELY HOT ENVIRONMENTS

by J. D. Fisker and C. E. Bell

Personnel of the Royal Navy are, by the very nature, of their calling, liable to be exposed to a wide range of naturally occurring and man-made hot climates during their careers. As such, it is necessary to assume that totally hot maintenance and repair men may live and work in any or isolated regions provided that an appropriate life style is adopted. Unquestionably, however, the Servicemen is not always in a position to follow the tenets of prudence and may be obliged to perform heavy work greatly exacerbated by heavy military equipment and protective clothing, at any time of the day or night. In such cases, sudden heat collapse is an ever present fear of which the medical officer would be well advised to keep in mind. In industry and in parts of ships and other shore service units men may be required to work in so severely hot conditions even in summer circumstances, while accident or injury may even result in thermal conditions becoming so severe as to place a fatal limit upon the time for which men may work or be exposed to them. Because of the lack of evidence and the inability to experiment upon thoroughly alert individuals they are found only in the more ultimate burning etc. bodies of men wearing impermeable protective clothing in ambient conditions which in other circumstances would be perfectly tolerable.

Available use of the scales of Effective and Corrected Effective Temperature, and the Wet Bulb Globe Thermometer (WBGT) index of environmental severity according to circumstances and preference and in unbearably hot environments the com-

plaints for the determination of safe exposure times described by Bell, Crandall and Williams (1970 and 1971) will substantially indicate the number of heat collapses which might otherwise occur. Inevitably, however, there will be a number of men, individual in heat, who may suffer heat collapse even if such precautions are taken and it would be highly desirable if a means could be found of identifying these men before they were exposed to heat or, if this cannot be done, of recognizing the symptoms of an impending heat collapse so that they may be removed from the heat before suffering more serious heat illness.

Beginning in 1962 a series of experiments were conducted under the aegis of the Royal Naval Personnel Research Committee in which volunteer engineering personnel were exposed to extremely hot ambient regions ranging from conditions in which the majority of men could safely be exposed for a period in excess of four hours to those in which subjects would be exposed to suffer heat collapse within five to ten minutes. During these exposures in the heat the volunteer subjects were conventional English men thinking of working of maintenance duties overall work. Under room heat, an engine room cap was optional and they could, if they wished, carry a towel over their shoulder. All the men had volunteered for the experiments and were pronounced fit to participate following a thorough physical examination prior to their first exposure to the heat. The purpose of the experiment was explained to every subject and it was emphasized upon them that the quality of the results to be obtained depe-

did in a dry-bath upon their willingness to work themselves to the limit of their endurance in such climate. At the same time they were told that horses were not required and that they would be recompensed in the canteen at all times by an impartial observer wearing protective clothing one of whom would be a medical officer. Of the eight men, five who participated all wore engine room personnel who had previously experienced engine room conditions in the tropics but were at the time of the experiment unaccustomed to heat. One subject was a Chief Petty Officer but all the rest were either RM's or LMR's. Their mean age was 22.5 years, ranging from 18.08 years, mean height 174.1 cm, range 158-188 cm, and mean weight 70.72 kg, range 54.03-95.00 kg.

In the first of the trials carried out in 1962, the responses of eight men exposed to climate in the range 37.0-39.0°C to 62.0/57.0°C dry-bulb wet-bulb temperatures, with an air movement of 0.78 m/sec were examined the findings being reported by Red, Hallow, Harvey, Naud and Brown (1965). A further 30 men were exposed to climate in the range 31.5/33.0°C 53.0-58.3°C dry-bulb wet-bulb temperatures with an air movement of 1.02 m/sec and the results were reported by Red, Walters and Wynn (1967). Generally speaking all the climate conditions to that date had been hot and humid but, with the advent of pre-seasonal preparation for HMD Ships, the possibility of hot and dry engine room conditions was envisaged and so a third trial was arranged in which two groups of 24 men were exposed to thermal environments ranging from 37.0/31.0°C/53.0/41.2°C dry-bulb/wet-bulb temperatures. This range included very hot and humid environmental conditions not encountered to date as well as very warm conditions with a low relative humidity. A composite report combining the findings of this phase of the trials programme and those of the

previous two was published by Red, Crowder and Walters (1970) and further discussed by the same authors in 1971. In these papers a total of 102 observations from 37 subjects exposed to 21 very hot environments, described above were analysed and a graph described whereby safe exposure times for young, fit, unacclimatised men destined to normal engine room climbing and working is a steady rate of 180 J/min in air movements of 0.78 to 1.02 m/sec could be derived from maximum means of the dry-bulb wet-bulb temperatures of the environment. Nineteen days of preparation for the derivation of these times with limits of confidence ranging from 80-90% were included in the 1970 report.

The recommendations contained in these reports have a wide field of application in the Royal Navy and indeed elsewhere and there is no doubt that the strict limits of derived safe tolerance times could prove most useful in predicting the length of time for which men might be exposed to extremely hot conditions without significant risk of heat illness. Nevertheless it should be remembered that whatever the degree of confidence shown for the derivation of a safe exposure time there will always be a number of men, however small, who will suffer heat collapse in a large population. By the same token there will also be a number of extremely heat tolerant men in the same sample. The method of estimating safe tolerance time also presupposes that the conditions of a particular heat exposure are constant throughout the exposure. The factors concerned including the thermometric parameters, work rate, clothing worn and the availability or otherwise of an adequate supply of drinking water. Clearly therefore it would be advantageous if a man could be found whereby these men most likely to suffer heat collapse could be identified before their first exposure to heat and also to recognize the signs of imminent heat collapse as these

working in extremely hot but varying conditions and with perhaps little other factors important in itself.

While the protocol for the three experiments described above did not include any provision for manipulating these problems an attempt was made to discover some parameters or aspect of personality which would be used as a predictor of heat tolerance and subsequent to the completion of the series an analysis of the observers and subjects concerned as the latter started a time of maximum heat collapse was carried out. It appeared that the conditions of the experiments were suitable for such an analysis because the environmental conditions were accurately controlled, the subjects were accurately monitored with regard to body temperature and pulse rate and could communicate freely with the observers who were observing them throughout every exposure and in most of the instances heat collapse was likely to occur before the subjects became too physically tired to continue with the experiments. The only problems lay in the fact that the men themselves were volunteers and Bell (1962) has drawn attention to the caution required in interpreting data derived from volunteers to enable it to be obtained from 'practical men'.

Despite a careful scrutiny of physical characteristics and parameters together with a personality assessment of each subject it was not found possible to predict in advance those most likely to perform well in the heat. This was a considerable disappointment although other workers have not found much better in the past. Ellis, Peters, Lund and Newling (1963) for example considered the problem but were left with the firm conviction that none of the methods available at the present time for predicting the probability of survival under extremely warm conditions are satisfactory. The only way to determine with confidence how men will react is to

expose them to the conditions in question and see what happens. We noted especially in previous studies or not men would collapse in the series. It is worth noting however, that the comment is attached from a work published prior to the work of Bell et al (1962-1970) which as discussed above outlines a method of predicting the likely performance of groups of men exposed to extremely hot conditions but could not predict in advance individual subjects who would be more than usually tolerant of heat. Lakerson, Werner (1958) in a discussion on the prediction of heat stroke conditions suggested that in selecting subjects factors to take account of well outside of course the medical history so as to eliminate those with cardio-vascular disease, recent probably heat prior working capacity and obesity. More sophisticated selection required a full exposure of individuals to simulated heat tests for the determination of those that are heat resistant. It appears therefore that in any or divided case the subject should be exposed to the given hot environment for a time within the limits recommended in the report by Bell et al (1970) under conditions of strict supervised full unassisted exposure determined in the light of the findings.

In the present series of experiments the observers in the climatic chamber were guided in making their assessment of an actual heat collapse in the subjects by a requirement that the exposures should terminate at a point before collapse had occurred which would enable the subjects to leave the hot environment unaided. Clinical judgment based on previous experience in observing subjects working in hot conditions in the desert with hot unsupportable as in the general appearance and dimensions of the subject, his attitude to the task at hand and his morale. As a guide has however it was agreed that a high and rapidly rising pulse began to de-

rectal surface) rectal temperature of 37.8°C at above depending on the particular subject, together with an irregular pulse rhythm of a pulse rate, palpated at the wrist of 100 beats per half minute or more, would be sufficient to convince an expert. Considerable weight was also given to the general appearance of the subject with particular attention being paid to his ability to carry out the sleep stopping task correctly. As the time time notes were made of complaints of general discomfort (heat and joint aches and aching) and the comments unambiguously expressed opinion of the subject that he could no longer continue with the experiment. On a few occasions in the course of the rhinometer exposures were terminated before the subject had reached a state of arousal from sleep, because these subjects had become tired owing to the length of time for which they were required to sleep up and down on the stool. There was not a

problem because supplies of warm glass and drink kept body temperatures were fairly suitable and the warmest drink as well as the quantity of warm fluids consumed was recorded.

From the records made during such an exposure an analysis of the comments made by both the subject and observer was obtained and because there was no pre-arranged intention to stress out such an analysis there was no agreed format for noting these comments and so their subsequent analysis was not as easy as it might have been. Nevertheless it was possible to distinguish the different comments by placing them into groups of like complaints and then placing each observation in time and classifying it in terms of the proportion of an individual's exposure which had elapsed when the comment was made. In this way 14 groups of symptoms could be defined plus an additional group of complaints which occurred nearly continuously only

TABLE I

INCIDENCE OF COMPLAINTS ON RHINOMETER STIMULI MADE BY EXPERIMENTAL OBSERVERS

Observations	Number of observations	First stage observation of observations				
		00	01.00	01.50	02.00	02.30
Tired every week when released	148	18	23	34	170	204
Stopped sleeping						
Awakening suddenly jumping straight up	118	17	14	20	83	112
Feeling that while light-headed head swimming	115	18	17	41	47	117
Headache, feeling of pressure, eyes in movement or beginning dimming	78			51		128
Melancholy gaze back towards wall going straight up	40				18	72
Lips were weak heavy when going	38	10	14	110	167	204
Feeling cold, warm, warm, cold, warm, cold	38			50	107	121
Impulse to stop when legs were in motion	38	14	13	207	178	207
Feeling rough	25			48	118	140
Headache	20			87	127	141
General ache, cramps	15	10	11		110	141
Fat and mouth, feeling burning in circulation of the	11	17		77	77	128
Localised numbness	11			81	110	141
Stimulus on device when state before sleep	5					140
Others—General headache, headache, back ache etc.	7		141	101	117	141
All observations	100	17	11	140	118	141

cess during the tests. Very few observations were made before a given exposure was at least half completed so within each group of ages the percentage frequency distribution was estimated for each 15 per cent of the time left in the exposure. The observations were not evenly distributed between the groups of ages but their percentage is shown in Table 1. In examining Table 1 it should be appreciated that in an exposure lasting 15 minutes the total 15 per cent exposure of the observations occupied only two minutes whereas in an exposure lasting 30 minutes the final 15 per cent occupied the last eight minutes before the exposure was terminated.

Referring to Table 1 it will be seen that weakness and related symptoms occurred for the largest number of observations and exposures of visual disturbances the least. In some of the groups the frequency of occurrence of the observations was spread fairly evenly over the last half or third of the exposure with as the 16 complaints relating to weakness in the legs and the 25 cases of weakness in the arm were mostly last third. In other cases comments showed a marked and sudden increase to the stage of maximum heat collapse occurred. The 71 comments about loss of motion occurred in the final stopping phase of the 45 comments regarding loss of motion being in position and the group of symptoms including dizziness and nausea would fall into this group.

Similar observations have been made by other workers during the course of three experiments. In 1958 Warner in a study of voluntarily restrained female seam workers engaged in a shovelling task followed by a period of standing upright found that as these subjects showed no collapse the first signs were a bending forward of the head, closing of the eyes, sweating, tenderness and redness of the body and a report to be allowed to lean on or sit down. The symptoms which limiting subjects experi-

enced were headache, weakness, nausea, pallor and a period of blackness. Barker, Aulic, Ross and Martin (1949), studying the reactions of physically fit heat acclimatized men consisting at a rate of 115-140 bpm one hour in hot chambers mostly has noted that the most described effects noted frequent complaints of too hot, throbbing headache, dizziness, marked fatigue with inability to keep the pace, difficulty in breathing, sensory type of peripheral pain and sub-normal, distress, abnormal attempts and nausea. More recently Ellis *et al* (1961) described the experiences of those who were not able to complete their tests as terms of 'symptoms of dizziness, light-headedness, sluggishness, muscular tiredness, pain, pins and needles' in the extremities, headache, abdominal discomfort, nausea or vomiting or acute 'hot flashes, fatigue', with loss of play ability in engine working. These authors also noted as their experienced exposure that, there was standing because too hotness, they doubted they paid little attention to the observer, occasionally there they were about and eventually relaxed, or were unable to go on.

Finally in these investigations, it was reported that, availability was frequent and continuous of hot longer or emotional sweating was not uncommon, when men were nearing the limit of their resistance.

As might well be expected there is a close similarity between the findings reported here and those of other workers in broadly related fields of investigation. In this instance however an attempt has been made to classify the symptoms associated with maximum heat collapse in the subjects taking part in the experimental programme and to allow a frequency distribution to them. It is perhaps unfortunate that the symptoms reported are not specific but they are nevertheless useful in the medical officer in predicting the occurrence of collapse in men exposed to heat.

Heat tolerance in connection with other heat disorders is essentially a personal characteristic. When the environmental conditions are constant and the exposures are young and of acceptably accurate predictive limits of safe exposure times may be made as described above and the most heat sensitive men will be identified after several exposures to the heat. Although it has not been possible to define a predictor variable which will predict the tolerance of a given individual to heat to be forecast there are certain characteristics which adversely affect the ability to withstand heat in general, for example young and physically fit men are less likely to succumb to the effects of heat than the old and weak men. In general, men tolerate heat better than women those with cardiovascular disease are at an obvious disadvantage as are those with a known reduction in working capability or recent injury from heat strokes. Most personnel tolerate heat disorders better than those who are not so conditioned (Wendham et al. 1959) but when the stress and problems are as severe as those to which the subjects of the study described above were exposed performance may be best has little influence upon their ability to withstand a temperature and humidity. With clothing that and the availability of drinking water are obviously important factors to be considered as well.

In summary, a study has used first-hand experience as a tool for providing an identity focus on interview individuals who are otherwise positively inclined to believe they are first exposed to a hot environment much more so than is needed to protect the guest property by the conventional use of thermocouple data and estimated safe exposure times. If heat is indeed an individual's most uncomfortable exposure to severe conditions then the young men of tomorrow heat conditions should be

There will be no mistakes in identifying such cases before they suffer more serious health injury.

Age Group	Percentage
18-24	25%
25-34	20%
35-44	15%
45-54	10%
55-64	8%
65-74	5%
75-84	3%
85+	2%

- [illegible]

apertory system, and the degree of ventilation is dependent on the level of carbon dioxide present. What is interesting in long term exposure is the time course of compensation for the acidosis as reflected by the blood pH level. Figure 1 summarizes the findings of various workers at submaximal levels of carbon dioxide. It will be noted that the time to compensation is the return of pH to approximate control levels or less considerably at the different studies. Schaefer's work at 1.5 per cent using various blood gases, the most obvious changes in this case compensation was finally achieved after 72 days of exposure. This is supported by Bagshaw's work at 0.7 per cent using arterial blood, but not by the others at a similar level. Schaefer carried out many experiments to animals and man at various levels of carbon dioxide, and his findings led him to postulate three reference levels for chronic carbon dioxide exposure on the basis of his demonstration that the time to compensation varied inversely with the level of carbon dioxide to which the subjects were exposed, and this appears to be borne out by Moore's work. From this Schaefer predicted a level of about 0.7 per cent carbon dioxide at which neither compensatory nor adaptive changes in other body systems would occur which would be safe for continuous exposure under submaximal patrol conditions (Schaefer 1967). However, it is generally accepted today that compensation for any level of raised carbon dioxide is completed within a few days, and adaptive changes in other systems is described below are well seen at around the 0.7 per cent CO_2 level. It must be borne in mind however that studies of acid base balance at this level of carbon dioxide are rare indeed and have not been carried out under laboratory conditions: the latter will be presented shortly in the Devereux sealed chamber at the Institute of Naval Medicine.

Other factors of importance seen in acid

base studies are a plasma bicarbonate rise with the later development of renal excretion of large quantities of bicarbonate, a parallel fall in plasma chloride, an increase in red cell volume and a fall in plasma volume. Urine excretion also occurs across the red cell membrane as an ionic or end cell volume and sodium and a decrease in potassium taking place (Schaefer *et al.* 1961).

Consideration of the responses of the buffer system and the possible body stores for carbon dioxide leads one to conclude that during continuous exposure the excess quantities of carbon dioxide to be borne eventually saturate both buffer systems and stores. The acid base changes described and the changes seen in blood and urine levels of calcium, magnesium and phosphate discussed below, support this in some ways, that even the body buffers available store for carbon dioxide is saturated, the excess carbon dioxide is excreted by the kidney, and the blood pH returns towards its pre-exposure level (Dwyer, 1972).

Calcium, Magnesium and Phosphate Metabolism

In view of the probability that long acts on the major carbon dioxide store, one would expect to see a reduction of this in calcium and phosphate metabolism. Changes in blood levels of these two substances during exposure at 1.5 per cent carbon dioxide reported by Schaefer *et al.* (1961) show a biphasic relationship in the blood pH changes described above and continued in the recovery period in keeping with the release of carbon dioxide from the other chemical changes at lower degrees have been seen under 80% volume per cent conditions (Gray *et al.* 1969, 1974) and in US Space voyage simulations (NASA Report, 1970) at lower carbon dioxide levels. The main supine changes however are seen in the urinary excretion pH



Fig. 1. Subject's carbon dioxide output during exposure to the submarine life.

ture. Figure 1 shows the average output of carbon dioxide under submarine partial conditions at various levels of carbon dioxide reported by Schaefer *et al.* (1964), Gery *et al.* (1973) and Peck (1971).

Soon after exposure starts, the output of carbon dioxide to a level approaching one half of the pre-exposure levels and remains there for the duration of the exposure. Of even greater importance is the fact that exposure remains low after exposure has ceased for up to yet undetermined time. Similar changes are seen in magnesium and potassium excretion as depicted in these two in the state of excretion is not yet known, but in either case an alteration of metabolism has taken place which may be of considerable significance to the long term health of the submarine. It is probably that the major cause of these changes is the raised carbon dioxide level in the submarine environment, but other factors may play a part especially the lack of sunlight leading to diminished production of Vitamin D and the alteration in physical activity and dietary habits under partial conditions. However, measurements have not yet been made at the submarine environment, but the transmission of the whole problem under laboratory conditions, slowly to take place at PM, will include Vitamin D and parathyroid hormone assays.

Respiratory Physiology

Acute hypoxia effects on pulmonary functions are not seen in these relatively low levels of carbon dioxide but a significant rise in PaCO₂ of 1.6 mmHg over control levels accompanied the induced respiratory alkalosis and is maintained throughout the exposure. Evidence for long term effects on the respiratory system of subnormal levels of carbon dioxide is scanty, but amongst changes reported are increases in anatomical and physiological dead space and a reduction in sensitivity of the respiratory center to further carbon increases in inspired carbon dioxide (Schaefer *et al.* 1964 b).

Hematology

A program for the hematological screening of the health of RN submarine crews has recently been completed at the Institute of Naval Medicine. The blood picture was compared with those of various control groups. These findings relevant to the physiological effects of the submarine environment include a consistently raised mean corpuscular volume (MCV) evokes whether measured by electronic counting techniques or by calculation from the red cell counts and PCV. Small decreases in red cell counts and haematocrit values were also noted, but the significance of these is doubted in the absence of information on total blood volume. In direct contrast the haematocrit values of some men returning from patrol were considerably higher than would have been expected in the range 18-22 g/dl.

An environmental factor not yet discussed which might have a considerable bearing on these blood findings is that of the presence of raised levels of carbon monoxide on board and the induced carboxy haemoglobinemia in the submariners. The submarine maximum permissible carbon monoxide (MPPC) for carbon monoxide is

PHYSIOLOGICAL RESPONSE TO THE SUBMARINE ENVIRONMENT

by R. H. Barker

Introduction

A submarine can be broadly described as a pressure vehicle which can submerge and travel underwater and in which the crew are exposed to an atmosphere maintained at an overall normal sea level atmospheric pressure. As such submarines have been operational for well over 70 years but until recently they could be considered only as submersible vessels that being necessarily powered by diesel fuel engines requiring frequent access to large quantities of air to burn the fuel. In these circumstances little attention needed to be paid to the specific respiratory requirements of the crew and the physiological responses to the conventionally-powered submarine environment were therefore those of exposure to intermittent periods of hypoxia and of hypercapnia; the breathing atmosphere being for a period of time submerged being 18 per cent oxygen and 3 per cent carbon dioxide.

A completely new set of circumstances arose when nuclear propulsion was introduced into submarines some 30 years ago. Nuclear fuel does not require any gas to release its power and the concept of the true submarine with purely increased underwater endurance was finally realized. Nuclear submarines have been operational now for over 15 years, and during that time numbers have built up to that there are now probably well over 100 at sea at any one time with at least 15,000 men manning them. Because of the novel environmental problems created these men have been carefully studied and vast amounts of biological data have been

accumulated from them. A number of physiological, biochemical, hematological and psychological facts about the nuclear submariner have been established from this data, and it is possible to account a pattern of these facts which might lead one to define a specific "Submarine Syndrome". This paper examines the physiological and biochemical manifestations of the syndrome.

The Environment

Before examining the changes found in the submariner it is worth considering briefly the environment which gives rise to them in order to identify those probable causative factors. The total pattern of the patrol environment has been pursued sufficiently well in the past to need no comment here (Lambert *et al.* 1971), the patrol pattern being up to 150 men living totally enclosed and isolated in a steel hull beneath the sea continuously for two months at a time. They are exposed to very little natural or bioluminescent light throughout the 24 hours of the day and have no respite or periods of recovery away from these conditions as they would in industrial or outdoor ship environments where at points would normally be only during working or research leave. Table I lists the environmental factors likely to be of significance in the production of the bio-logical changes to be described.

Table I

Environmental Factors of Physiological Significance in Nuclear Submarines

- 1. Potential toxicity of atmosphere constituents

- v. Potential physiological hazard from nuclear reaction.
- vi. Carbon dioxide: 1 per cent level.
- vii. Absence of sunlight.
- viii. Limited physical activity.
- ix. Deaerated drinking water and relatively undisturbed rest diet.
- x. Carbon monoxide: 33 ppm level.
- xi. Climate environment within the safe norms.
- xii. Absence of many normal physical psychological and sensory stimuli.
- xiii. Watchkeeping system and lack of natural time cues affecting biological rhythms.

These manosphere constraints and restrictions are whole subjects in themselves and are not discussed further as they are unlikely to be of significance under conditions of normal submarine operations.

Carbon dioxide is allowed to reach a level of 1 per cent, some thirty times greater than its normal atmospheric level, and this factor is apparently the cause of many of the biological changes seen in the submersor. One area of change is calcium/magnesium/plasma/serum metabolism and the absence of sunlight, limited physical activity, the use of distilled water only for drinking purposes and the availability of a relatively undisturbed rest diet, may all contribute in this area.

Carbon monoxide, at the level permitted is thought to have effects particularly on the cardiovascular system and possibly on the central nervous system. Climate effects would not normally be expected because the submersor is, in effect, isolated for highly efficient pre-conditioning, but the absence of normal environmental and social stimuli may have effects on hormonal balance and on the autonomic nervous system.

The variable watchkeeping system is not coupled with the lack of natural light but when on time-eyes will affect biological

rhythms, but it is likely that physiological changes observed by them will be outweighed by other factors previously noted. However, they must be borne in mind when examining specific physiological or biochemical parameters as levels measured may be affected by the relationship of the time of sampling to the natural time of day, time taken for subject's last period of physical activity and the subject's watch-keeping cycle and sleep pattern.

Physiological and Biochemical Findings

Many investigations into the physical post-mortem of submersors on long periods have been carried out since the past twenty years, particularly in the US Navy. Field studies in submersors are fraught with variable dangers, and the value of much of the data collected can be discerned fairly easily. However serious human problems appear again and again, some of which have been, and others of which are about to be subjected to laboratory analysis, and it is these which are discussed below.

Short Time Trials

As would be expected, exposure to raised atmospheric carbon dioxide values in a



Fig. 1. Blood pH during exposure to raised CO_2 .



Fig. 2. The relationship between CO level and COHb level.

(15 ppm) and this, in theory, should give an equilibrium carboxy haemoglobin level of 4.5 per cent in all volunteers. The control level of carboxy haemoglobin found in RN polaris volunteers are around 10 ppm giving a theoretical level of about 1.5 per cent COHb. Smoking habits have a major role in producing the COHb levels found in practice and Figure 3 is a composite figure summarizing the mean levels of COHb found in volunteers who are either non smokers or medium to heavy smokers. As can be seen at the first quoted ambient CO levels, above the non smokers carry a level of less than 1 per cent COHb insignificantly produced while the smokers carry a mean level of about 4 per cent. At 10, the non smokers' COHb had achieved the theoretical level associated with the ambient CO while that of the smokers appears broadly to be the sum of the levels induced by the ambient CO and the smoking in the lungs, the smokers' mean level of 10 ppm is a little greater than that which would have been expected, and this is probably due to the different COHb measuring techniques used in the 10 ppm group compared with the above and 15 ppm groups. The point to be observed however, is that at an ambient level of CO corresponding to the HPC, the non-smokers' health is prejudiced by a level of COHb

equivalent to that caused by medium to heavy smokers alone. However, it must be noted, in CO poisoning studies on board ship that the current ambient CO level is around 10 ppm. has improved the situation so that the volunteers' health is not now so prejudiced. There is considerable evidence now to show that constant COHb levels of 5 per cent and more are associated with the early development of coronary valve disease. Evidence has also been produced to show that central nervous system effects also occur at these levels resulting in decrements in certain tests of mental performance. This such decrements usually occur at below 10 per cent COHb has always been doubted by the Royal Navy and its officers, and recent evidence (Shaw et al 1974) has supported this.

To return to the increased MCV seen in active polaris volunteers, this could be a reflection of the altered physiological state described as relative to the increased carbon dioxide level, a direct effect of the increased methaemoglobin level itself, compensation for an induced relative anaemia, the reduced oxygen levels found in volunteers being normal or to a combination of these factors, plus any other haemoglobin variations, this may be general. Increased MCV's have been seen in other age groups in civilian populations (Edlin, 1971) and this may be due to less efficient respiratory function in these groups giving rise to effects similar to the raised PaCO₂ seen in volunteers. Increased mean red cell diameter values are well recognized at higher PaCO₂ levels (Shaw et al 1974). If relative anaemia was a primary cause one might expect an increased haemoglobin level or red cell count, but this have not been found except in certain individuals who may be particularly sensitive or in response to the various environmental factors. The highest MCV's were found in smokers, individual values in excess of 100 µ³, being fairly common and in these subjects, given

ally have the highest CO₂ levels it may be that an increased MCV is a direct response to increased CO₂ load. Further work under environmental chamber conditions will elucidate this pattern.

Conclusions

Summarizing the physiological and biochemical measurements of exposure to the nuclear submarine environment a submaximal might be expected to show a mild respiratory acidosis in varying degree of compensation as chemically mixed PaCO₂, major alterations in pulmonary dead space arrangements and altered ventilatory response to further increases in CO₂. He may also show histological changes in response to the increased ambient CO₂ levels and alterations in cytokine responses and phosphorus metabolism which could be due to a combination of environmental factors. It appears that the prime target for any pathological disease would be the renal and cardiovascular systems. The question then arises of whether the changes described are of significance in the health of the submariner.

The available evidence shows that in the short-term there is no detrimental effect but the more important question of long-term effects cannot be answered because the nuclear submarine programme is not old enough for such effects to have become apparent. A comprehensive prospective submaximal programme already in force and properly monitored epidemiological surveys should assist in preserving the health of the submariner during both his service career and his later years.

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PSYCHOLOGICAL REACTIONS IN DIVERS

by J. S. P. Rawlin

Introduction

In 1918 Casanova, Diving Turret operating in conditions of total visibility at a depth of 100 ft reported episodes of disorientation and physical distress which caused them to break off the operation and surface. At the surface recovery was immediate and there were no physical after effects. They were convinced that confusion and disorientation, was the cause of the trouble and that after cases of acute loss was described. Numerous analyses of individual samples showed no loss of carbon dioxide absorbing power.

At about the same time Dr A. M. H. Bennett of the Royal Air Force Institute of Aviation Medicine was concerned with pilots of Caudron aircraft flying at 30,000 ft who became psychologically disturbed in the event had been described as ill-effects of not being in charge of the aircraft as if lost of being outside the aircraft, withdrawing themselves (Bennett 1941). Two years previously Clark and Goughal (1937) had described similar experiences amongst United States Navy pilots. They labelled the sensation of disorientation and depersonalisation 'The Break off Phenomenon' and stated that 50 per cent of Navy pilots who had flown at high altitude were liable for with the feeling of 'break off' and of those about a third found it disturbing. The majority found it pleasant and it appeared to it with elation. That degree of aviation medicine Professor von Willebrand (1943), in a presentation to the Third European Congress of Aviation Medicine (1956) revealed that many years previously and long before the break off phenomenon was described, he checked cases

of pilots flying solo at medium heights in non turbulent air between cloud layers with no visual line of horizon. They experienced sensation of disorientation and depersonalisation, some of which developed into actual hallucinations. He added, 'This happened mostly when the pilot was alone in a long or low subsonic configuration of flying hazards and signs in his efforts to focus attention on the parameters of his instrument panel — where nothing happened'.

Like Clark and Goughal he found that although many pilots were familiar with the feeling of detachment by no means all of them found it disturbing. Some with an anticipatory imagination, instead a feeling of exhilaration and excitement like a care-free child. He concluded that absence of habitual stimuli constitutes an excruciating stress especially under conditions of imminent danger.

It occurred to Bennett and myself that the situations in which we were interested were similar in some respects. The Canadian pilot at altitude was in complete isolation in the near-total brightness above the clouds his compass showed absolute isolation and he felt alone and only his fuel gauges inconspicuously remind the pumps of man. There is a considerable reduction of stimulus. The diver on his own in the dark and silent, virtually weightless and relying entirely on his own life systems for appreciation of altitude is also in a 'isolated environment' in conditions of total visibility at the same depth with the same apparatus symptoms never occurred. We modified the hallucinations were frequently reported by explorers who

were done, for long periods in the above landscapes of the Arctic like "beaming-back" look-outs of Fred (1950) and he sat, but not wandering in the desert. Also but in the German jungle had under half attention although the scenery and people were very constantly keeping the picture of changing numbers was always the same comparable to a room filled with a pin-point up of colored patterns in the evening psychodisks, shapes of a person in the landscape.

A vast literature has grown up around the concept of sensory deprivation, some of it fascinating and illuminating, some of it irrelevant, superfluous, or composed of blinding chapters of the obvious. Numerous experiments have been carried out with subjects isolated in sealed rooms fitted with various colors and glowing colored patterns and translucent goggles (Berman and White, 1955) or confined in boxes (Gibbs and Wiggett, 1956) or compression chambers (van Wulven Palthe, 1956) or immersed in water with head masks and electrodes (Lilly, 1956).

Such exposure to a reduced environment have been varied by the superimposition of white noise, of musical or environmental tapes played backwards, of monophonic sounds generated by a 4000-cycles/sec. of sinusoidal light, and of actual psychodisks patterns generated by a bank of twelve 150 watt air jet bulbs.

For some reason Lilly's experiments have achieved the most notoriety. Two subjects of which he was into were stationed in a tank of slowly flowing water at 54.7°F moving nothing but a shielded one-inch which covered the whole head and was fixed with a breathing tube. The longest exposure was three hours. Lilly described an stages of experience as follows:

1. The days' routine Awareness of surroundings revert problems on
2. Reflection and enjoyment

3. Tension. "Stitches" began, but no longer during the water still conditions as achieved by slow swimming movements, or holding one finger against another
4. If the device is successfully removed leaving someone, perhaps in the point of leaving the subject to leave the bath
5. Unusual feelings are experienced of a highly personal and emotionally charged nature, which Lilly described as not personal to others publicly
6. Finally, if the tension and tension are withdrawn there may be actual proposition of actual imagery. The black curves in front of the eyes gradually open out into a three-dimensional dark empty space. Gradually large space small irregularly shaped fragments. A tunnel whose inside space seemed to be carrying a blue light appeared straight ahead.

Lilly concluded that isolation put in acts on most persons as a powerful alarm. The effects observed were similar to those of any other extreme state.

Why bring this up again after all these years? The reason is that sensory deprivation remains in the news. In the *New Yorker* of Nov. 1971 is an interesting article titled "Working a Better Therapeutic." It was alleged that subjects under observation at Northern Island were strapped hand-cuffed to support them when against the wall by holding on their fingertips and then subjected to a deafening noise. It was claimed that the toll might need to stand back in Lilly's most recent experiments, a somewhat far-fetched suggestion. Berman (1971) reported on 70 persons offered the clinical treatment for cases of "depression or flight." Twenty-two persons described feelings of isolation and detachment. 11 of these were listed

many pilots, who had been flying above 30,000 ft, were very fatigued pilots who had been flying at heights between 500 and 10,000 ft. These pilots reported many perceptions of aircraft altitude and velocity they had become very apprehensive and feared they were losing control. Several added that when recovery had been off on descending and refueling. About one third fled in descending and three 39 cases were taken from the group. He suggested that the optimal decompression occurring at a concentration of break off was caused by some degree of vestibular asymmetry. In other words sensory depression reduces the subject's capacity to make degree of self-regulated sensory information.

Experimental Method

Brown and I decided that we would attempt a pilot study of this condition by a technique aimed at producing the most complete reduction of the environment possible. The subjects should have nothing but nothing on nothing, i.e. as possible, they should be weightless and the only source becoming again would be from the inside system.

Accordingly, with the technical assistance of the Admiralty Experimental Diving Unit we designed an experiment in which the subject was completely contained in water at 10 ft at a depth of 4 ft suspended from centrally and supplied with air from a tank of own hood. The pressure was maintained by filling the subject with a cotton compress material and attaching small weights to the back and limbs to the front. The limbs were distributed by the material and were so small in the observed situation that the subject was completely unaware of any sensation other than floating. Air was supplied by continuous flow through large silencers and adjusted directly by the subject for his own comfort by a small water filled bag whose displacement up or down on the water determined the loading of the



Figure 1 and 2

subject from the environment. The front was filled with a structure the shape of which was fed into a bag, however. When the subject was in position a mask was fitted over the facepiece and the subject was then in darkness (Fig. 1 and 2).

The total experiment was done twice, although I did two experimental experiments for the limbs, and that was to ensure why it should not have been extended to 12 hours or more. To me and to 73 of the 26 subjects the experience was pleasant and completely relaxing and I eventually slept much of the time. Two subjects, however, had minor experiences of rapid water movement and in one case of water being let out of the tank. These experiences appeared within 30 minutes of the start of the experiment and although attempts were made to keep the subjects as passive they moved on coming on and remained aggressive and altered motion for the rest of the day.

We derived a theoretical explanation based on an alternative view upon electrocortical systems. Similarly, people self-regulated movement but the efficiency of the system is a function of its signal to noise ratio. The human nervous system also produces noise in the form of neural patterns when the eyes are closed or in darkness, tremors and shivers in the air when in complete absence of movement from the environment or one's and feeling pain throughout the body. Therefore it seems that we are aware of the possibility of loads but having discomfort.

All these self-regulated behaviors of movement are normally ignored because of the intensity of the incoming stimuli due to nature of traffic or all moving machines movement of vehicles and human load in movement, vibrations from the shore on which we sit and the movement of clothes over the skin at an often new position to facilitate the various means. They are the signals as opposed to the noise.

In the tank there are no such constraints and the limbs being hydrostatically supported there is no need for movement to avoid the various forces and complete the motion is for hours is possible. Under these conditions there is no signal and the signal to noise ratio is affected in favour of noise. There is thus a tendency for noise suppression to be directed to endogenous responses and if the situation is prolonged the subject may confuse them with exogenous sensations, and come to believe that they represent the situation in the real world. Hence the claims that the water in the tank is moving and the conclusion that the experimenters were in playing a trick on the subjects.

The first in the analysis is that this misinterpretation of endogenous sensations might be a function of time. After all before going to sleep at night one makes every effort to reduce the environment as much as possible excluding noise and light

and preparing a bed which gives the most rest and therefore comfortable support. However, once in the tank as sleep state has no value significance is attached to them. But if the half-asleep state were maintained for hours or days it would not be surprising if hallucinations resulted.

In our two devoted subjects, but more time appeared that a few minutes, it is conceivable that in such a short time a misinterpretation of sensation occurring in digestion channel can take place at least in the absence of other factors. However, it is significant and consistent to all the reported incidents quoted that the subjects were isolated to the extent of being physically and psychologically cut off from their fellow men. Furthermore, these two particular subjects were the only two who were neither divers nor had been concerned in the development of the floating equipment and they themselves admitted that they had had little confidence in it.

Thus they were morally stressed before entering the water and once they were in total isolation. In these circumstances this interpretation of endogenous sensations and divergent analysis of their significance is likely to take place very quickly.

Conclusions

Clearly to believe now that isolation per se or in a most persons is a powerful stressor isolation per se has been being viewed as a stressor enough by many people at work time or weekend commonly at night when going to sleep but also for longer periods experienced by such persons as religious retreat, retirement to remote islands and sophisticated long distance sailing. Perhaps one of the best documented examples is that of Richard Ford (1998) who floated in open 40 mmetre alone in a wooden box dug into the sand 600 metres south of the base group at Hatteras. The experience proved deeply rewarding and physical stress turned the later weeks into

HUMAN FACTORS IN HELICOPTER FLYING

by M. A. N. Mackie and J. W. Brown

With the phasing out of fixed wing aircraft on the Royal Navy in 1979 and the widespread use of helicopters throughout the Fleet, it is essential (H.M.C.76) and logical as well as common, any nuclear officer serving at sea may have helicopter service under his care. To enable him to assess the workload on his crews and when to watch for signs of stress and fatigue, it is important that he has some knowledge of

the problems of flying the aircraft, and those imposed on the crew during open (sea) flying.

Basic Helicopter Flying

Having completed 15 hours (ground) fixed wing flying in Chapmarr's and having received the course helicopter pilot's book with his manual basic helicopter, the Helier and his problems are tabulated in Table 1.

TABLE 1
COMPARISON OF FIXED WING TASKS

Basic Fixed Wing Tasks (Chapmarr's book, 1965/6)	Basic Helicopter (Helier)
1. Aerodynamic Stability — Generally not dynamically stable in case fly hands off. Will return to flight path if disturbed by a gust.	Unstable — Danger of hands off. If the tail rotor will continue to push and turn planes.
2. Controls — Simple — not limited and complex. Bank turn — normal climb. Thrusts give little bank effect.	Wing bank — lateral gyro bankwork and deceleration. To climb — requires roll into climb and thrust. Lateral torque from rotor — much harder controlled tail rotor.
3. Control — Generally — remains same throughout flight envelope.	Controls are like fixed wing above min power points and used in all levels below that but add ch propellers by rotor continuously in use changes. Lateral torque, thrust changes.
4. Movement of eye, control does not require, change in attitude.	Movement of eye controls needs changes in attitude 30 seconds, required flight path.
5. Aerodynamic stability, return flight path. Therefore aerodynamic flight, there attitude, indicated.	Aerodynamic does not indicate flight path. Must be lower power. With hands off in altitude flying, rotor ch dominating.
6. Essential task to be maintained, adjusted.	Essential to maintain rotor revolutions.

Aerodynamic Stability

Unlike a fixed wing aircraft, the helicopter is both statically and dynamically

unstable — if lower hands off it will start pitching and rolling at an increasing rate or if disturbed by turbulence, will continue

control, is the direction of displacement. This means that, at all times, the pilot must fly with his hands and feet on the controls.

Controls

In the hand wing variant form, the rotor, a control seat, rubber pedals, and a throttle move the seat back and the aircraft climbs. Lateral movement comes, the aircraft to bank and with slight rubber turn the aircraft. Change of throttle open and gives little torque effect on the aircraft.

To understand the controls of the helicopter it is necessary to have some idea of how a helicopter flies.

Lift and direction of movement is provided by the rotor which consists of a number of blades or airfoils driven through gears and a hub, which rest by the engine (Fig. 1). The position of each



Fig. 1

blade is a function of the lift on the blade the blade angle and the centrifugal reaction — the last depending on the rotor revolutions and thus engine power and collectively the blades form a cone (Fig. 2).



Fig. 2

Movement of the control in the left hand the collective stick, increases the pitch angle on all blades increasing lift but also drag thus tending to slow the rotor in doing centrifugal reaction and allowing the blades to fly upwards into a position the French call *Les Pales au Touche* (Fig. 3). The collective stick therefore is attached



Fig. 3

to the throttle and has an on and a reset grip to allow separate adjustment of engine power to maintain the required rotor revolutions. The right hand low-drag stick changes the pitch on the blades cyclically through a rotor revolution so that it affects a tip the rotor disc forward or sideways resulting in movement of the required direction. To counter torque from the engine rotor requires a variable pitch tail rotor driven by engine power from a shaft coming off the main rotor drive, where the tail wheel gear is controlled by the rubber pedals. The position above the tail-wheel unit allows maintenance of heading, if an engine failure occurs and the aircraft has to be rolled down in an emergency.

Control Sensitivity

In full air and from considerable power is required to maintain the hover, but as forward airspeed increases, the power is required to maintain level flight decreases and it is minimal at about 60 knots.

Indicated Air Speed (ft/s). Above this

max response rate

response rate



Fig. 4

speed helicopter controls required more or less, like those in a fixed wing aircraft, but below 50 knots in the lower range cyclic stick sensitivities change in that low and all responses become more sluggish while lateral responses become more sensitive.

Inter-Relation of Controls

In the helicopter a change in one control will require changes in the other three. For example as the controls move forward from the lower it uses less power to maintain level flight. The collector/pusher acting has to be reduced, there is less torque and therefore less power required by Tail Rotor Thrust requiring a smaller pedal correction. There is this constant interplay between controls which demand fine co-ordination of hands and feet, responding to the various small cues taken from the cockpit world. It is therefore easy for the pilot experiencing to maintain a lower to zero correct on lateral cyclic movements and to build up a pilot-induced oscillation.

Instrument Flight

In a fixed wing aircraft attitude reflects the flight path and therefore instrument flight is possible from the standby indicator. However in the helicopter as well as attitude information power setting determines the flight path. With the inter-

relation of controls and change of zero points in the low speed range instrument flying in the helicopter is an extremely demanding task.

Lastly the need to monitor the rotor revolutions and maintain the speed rotor area is drawn into the picture in low speed flight in instrument flight. This has led to such a fixation on the rotor speed low monitor that a turbine has afforded the aircraft leading to flying through 90° without noticing it.

Having considered raising pilots to fly fixed wing aircraft it is necessary to some degree to de-emphasize them as fly fully cockpit. It might be suggested that sub sonic helicopter training might be easier for the pupil. However this has been tried and found down for the following reasons:

- 1 The cost per hour for helicopter flying is 4-5 times greater than a fixed wing trainer.
- 2 Work a less demanding control task, it is easier to teach basic aerodynamics by keeping a good look out, map-reading and total visual reference, in a fixed wing aircraft.
- 3 If the pupil cannot cope with a simple acceptance, he is unlikely to succeed in a helicopter.
- 4 Lastly because take-off and landing is probably the most demanding work the pupil must learn the hardest thing first. In a fixed wing — he can learn to take off and fly forward eventually coming to the most difficult manoeuvre last.

However, as aerodynamic instability is one of the main factors leading to difficulty in the spiral phase, and this can be controlled by automatic means it might be easier to teach the trainer with his direction 180° and loop on when he has learned to cope with the controls, to fly a work fix, direction QUT.

During his fixed wing period the pupil has however learned to cope with some of the stresses of learning to fly in the low

is rather disappointing his attitude which leads to a reduction in performance and the psychological problems arising from the poor instructor relationship, and this goes to his helicopter training with the knowledge that he has succeeded in Part I of his training.

This is the position with the basic helicopter. However, the operational student

has extremely high standards for water leaving machines — complete controlled engine which maintains the correct power for any collective setting and a constant rotor revolutions control. The more sophisticated aircraft is really the enemy to fly — but all may find that this, given any knowledge is a lesser machine and must therefore learn to cope with it.

SOME OF THE MAJOR STRESSES INVOLVED IN FRONT LINE OPERATIONAL FLYING OF AMF HELICOPTERS IN THE ROYAL NAVY

Observations are confined to some of the main physical and psychical stresses involved in flying two of the Royal Navy's front line two seat amphibious helicopters. The Westland Sea King is the larger of these two, with a powerful rotor transducer which can be lowered from a height 10 feet above the waves to more than 200 feet below the surface of the sea. The second one operates from aircraft carriers, Royal class cruisers, County class destroyers and Royal Fleet Auxiliarys. The smaller one is the Westland Wasp is a torpedo carrying attack helicopter and operates from small light docks such as those of the Landing and Triad class frigates.

Noise and Vibration

Noise and vibration are constant and measurable elements of helicopter flight. They vary in intensity from aircraft type to aircraft type, and even from aircraft to aircraft. The Wasp is not a particularly loud aircraft from this aspect. Attempts are made to limit rotor vibration during test flying of each aircraft at the factory. However, even so, as the Sea King now takes has a particularly intensive and noisy environment. In the future, in low speed conditions when more power is required to maintain lift the noise level may reach between 145 and 150 db — with a large low frequency component. The ML 3 production flying helmet only provides for

frequencies 15 and 20 db attenuation at 250 and at 500 cycles. These frequencies unfortunately coincide with some of the operating frequencies of the Sea King rotor and the rotor operation tends to increase the volume of the noise signal to approximately 3 db above the background noise at low sea in order to achieve good discrimination. This can result in a dangerously loud noise signal and as the signal is contained in all frequencies could result in hearing damage in the high frequency range.

Before helmet noise attenuation is being sought, especially in the lower frequencies, in order to reduce the fatigue and stress caused by noise and vibration. Fatigue by treatment of the root cause of the problem would be most expensive and difficult to achieve in the present aircraft. However the problems are now much more widely recognized and it is hoped that they will be minimized at the design stage of future aircraft.

Environmental Temperatures

Environmental temperatures as high as 44 F WBGT index have been recorded on the tropics in the case of a Sea King during an anti-submarine search and it has been calculated that the temperature index probably reached as high as 82 F WBGT on a previous tour. The temperatures of 44 F WBGT has been assessed by the Environmental Department of the Ministry of

Naval Medicine at the figure at which measurably deterioration of performance took place in the work of aquatic beings under swimming. The job of these ratings is somewhat comparable to that of the rear eyes of a Sea King but I am informed by the Institute that 2 to 3 should be allowed for the added stress of flying (climbing and the increased burden). Besides the workload in the rear of the Sea King was an increase by very much higher than that of the aquatic ratings. As E.D.P. WRIGHT the Institute recommends that some form of personal cooling, for example an air conditioned suit, should be worn. This last stress is, partly a problem of the rear view as the pilot can open small windows and obtain some increased air movement around their own person.

In contrast to the other 'Wasp' pilots are flying from frigates off Iceland. Owing to an extremely poor anti-rotation characteristic, dropping a Wasp is a hazardous business at the best of times. Groups state when the helicopter is in the water are very limited if the cockpit doors are mounted and closed, and if that was the Wasp is only permitted to be flown over water with the cabin doors off. What two pointers in the water will below 50°C and a large wind chill factor through the open door the pilots can get very cold. They are provided with thermal gloves and boots but the wings tend to be unreliable and the carriers have no alternative control over this equipment (the only control is an on/off switch). Pilots have reported loss of finger mobility such that they have been unable to operate small switches and to pull control levers at the end of a flight. The doors being off can also result in sea spray being blown into the spray entering the cockpit and obscuring vision even visibility. All this and consequently streaming eyes and nose from the cold do not help the pilot's comfort or concentration while flying in these conditions.

Psychological and Flight Work

The Sea King provides no external problems in flight and whilst being flown during the day but at night the controls tend to be flown into the floor by an example and computer. The pilots are left unconsciously monitoring these characters for malfunctions, of the kind lost with their hands hovering over the controls and on a pitch level night with no external visual references, sudden alterations in height or attitude brought about by the computer to correct deviations from the planned flight can be very alarming and stressful indeed. A 45 hour motor on a really dark night can be very tiring. The Wasp, on the other hand is virtually always under the pilot's visual control and the most stressful area of flight is almost certainly going on and off a small platform and taking dock position in night. The helicopter will usually fly in any weather in which it would be possible to launch the sea boat in a rescue attempt should the Wasp deck. Fully loaded with weapons the Wasp has only a few rescue flights permitted with a large open field for two extra attempts at landing. With this short endurance to mind the pilot may launch after an hour of leaving sailing and towing, strapped into his seat at about two. He would complete his work under radar control and then approach the ship's deck partly under radar direction, partly on a light reference mounted on the ship's mast pulled a pitch path indicator and so he gets within half a mile partly under visual reference from the ship. Flying with such divided attention is very demanding and most Wasp pilots will admit to relatively frequent greater or lesser degrees of disorientation during launch and land on at night. This is particularly likely to occur when the pilot is in poor flying posture. Coupled with the sensory stimuli by a low fuel state, it produces a high degree of stress in most pilots.

The Waip pilot is usually the only pilot on board, he is the flight commander, and is the captain's adviser in aviation matters such as the local operating conditions. As most of the ships from which he will operate will not carry a medical officer he is also responsible for providing himself with medical supplies and when he does so he must hold in mind the fact that he thereby reduces the ships major weapon assets. This must be a very difficult decision to have to make for missions should he have a cold in the middle of an exercise.

Range

Range is much more of a problem during exercises involving air time conditions than it is under normal ship movements. A Sea King squadron provides the main air information source for the fleet during such exercises and the following is the average crew's workload during such an exercise in the Mediterranean in November 1972.

Three aircraft with six crew were detached to an RFA for two weeks. The average crew flew between 40 and 60 hours in the 14 days. During the most intense five days two of the three aircraft were virtually airborne at all times. The crew would be alerted one hour before a sortie and would land one hour before launch. The standard sortie would be between 4 and 4.5 hours and there would then be a debrief and preparation of a plot and records, taking about an hour. Thus the total work time involved in one sortie was approximately 11 hours (each crew averaged 11 sorties a day throughout the exercise covering a maximum of two sorties a day at the most intensive period). The pilots of this detachment reported afterwards that they reached such a state of fatigue that they were suffering occasional minor sleep while airborne and one

first pilot reported that he had snuggled out of one such sortie sleep only to enter his second pilot in a similar condition. This particular occurrence happened right at the end of the most intensive phase of the exercise. Had the exercise been on board the mother ship and reported such incidents in the time they would have almost certainly been provided by the medical officer.

The Waip pilot has similar problems, although he spends much less time actually in the air. Even during an exercise he must be allowed eight clear hours under no state of alert from which one of his final sorties at the day, to which off at the first order of the next period. However during the time he must sleep just his main meals and do any necessary squadron work. The other 46 hours he will be in a situation of alert if he might require to launch fully armed on flying, climbing and close to his aircraft. It should be stated here that flying on cold weather flying clothing can be very fatiguing in itself. Fourths of the 16 hours will be spent stopped into the air such as after 2 crew members to himself and he may be kept in that state of alert for up to two hours at a time during the day and one hour at night. From the conditions of alert he may be launched on a sortie right up to the last minute of the period he is allowed to remain in a hot two. Double pilot missions of Waip carrying frigates would ease this problem but it would also reduce each pilot's flying position to dangerously low levels.

To summarise very briefly the working time of a detachment of the aircraft was based on this intake can lead to such high mission helicopter flying in the Royal Navy being a very stressful and fatiguing occupation. Nevertheless it is on the whole supported with great determination, skill and high morale and achieved not in an often one and thoroughly professional manner.

THE PROBLEM OF DUODENAL ULCER IN THE ROYAL NAVY

by G. R. Milton Thompson

Any attempt to assess the extent of the problem of peptic ulcer and its particular duodenal share in the Royal Navy is difficult as our ability to establish the true incidence below, we can analyse the difference between duodenal share in sailors and in a civilian group comparable in age.

Dell (1952) reviewed the methods available for determining the true incidence of peptic ulceration in the community at large. He pointed out that national mortality statistics were unsatisfactory because of the low fatality rate. His main patients with peptic ulcer were never admitted to hospital and that if they were this was largely because of complications. He concluded that a population survey was the method of choice and Dell, Avery Jones and Black (1955) made such a survey, mainly in London. The special situation in the Royal Navy is however somewhat different. Few sailors complaining of indigestion in their work day except referred to medical out patients if their symptoms are at all persistent, although on arrival admitting such patients to hospital when possible. An investigation of naval hospital out and in patients records will therefore include the large majority of patients with ulcer symptoms presenting in the Barrack, Marine and Vascular Units. Jones and Vaughan Jones (1954) reviewed all cases of gastric and duodenal ulceration presenting in the Royal Navy in 1952 and showed that the overall incidence rate of duodenal and gastric ulcers were 1.7 and 0.2 per 1,000 men respectively. They had already investigated the same problem in the Army (Barrack and Vascular Units, 1952) and the Royal Air Force (Barrack and Vascular

Units, 1954) and concluded that there were no major differences in the incidence of peptic ulcer between the Army and the Navy although the Royal Air Force had a significantly lower incidence of gastric ulcer. Most recently Watt (1971) has shown that in the 10 year period 1959 to 1968 3,082 patients in the Royal Navy and Royal Marines had a radiologically proven duodenal ulcer while 184 had a radiologically proven gastric ulcer. The overall incidence for this ten year period was therefore 2.25 per 1,000 for duodenal ulceration and 0.19 per 1,000 for gastric ulceration. During the ten year period the annual incidence of peptic ulceration as a whole, rose from under 3 per 1,000 in 1959 to 3.5 per 1,000 in 1968. These figures suggest that the incidence of gastric ulcer has remained unchanged over the past 12 years but that the incidence of duodenal ulcer has approximately doubled. On the other hand data from the Hospital In Patients Enquiry in the United Kingdom quoted by Lippman (1973) show that the admission rates for duodenal ulcer have fallen by 8.7 per cent between 1958-60 and 1965-67 while rates of perforation perhaps a true measure of acute frequency in the community have fallen during the same period by 19.7 per cent. This trend is supported by data from York (Hawthorn, 1968) where the mean annual incidence of duodenal ulcer is under 1 per 1,000 population aged 15 to 54, fell from 2.4 in 1952 to 1.3 in 1961-62. Improvements in diagnostic techniques, for example the advent of the image intensifier and more recently of fibre optic gastroendoscopes, have been available

stated that there were significant differences between the personality characteristics of the two groups and in the presence or absence of emotional conflicts. More specifically he suggested that the hyper-arousal syndrome consisted of intense and lasting, and sometimes surrounding these onsets, I am not competent to assess the arguments nor to marshal the evidence in support of or against Binney's view that the psychological differences between the two groups were significant. The methodological problems of such arguments are considerable and the interpretation of the evidence is complex. Merly once stated, however, that a high level of general awareness as measured by various psychogenics combined with psychological factors predispose individuals to peptic ulceration which is ultimately precipitated by environmental stress.

The methodological problems already referred to make it difficult for us to know whether the Navy represents a different personality group from those who choose civilian life. If it were possible to show this it would be established that the type of personality common to the Royal Service is a predisposing factor to peptic ulcer. In attempting to examine this further we have used a simple personality inventory (the Maudsley Hospital Questionnaire) (Crowe and Croop, 1966). This is an easily administered and easily scored personality inventory aimed at measuring the importance of psychological factors when the experience of stress time would not be justified. We chose this test for three reasons. First, it is the questionnaire covered our parameters and would therefore describe a wider variety of psychosomatic disturbance. The questionnaire measured our five living anxiety states attributed to a disturbance sleep, phobias, anxiety hysteria or specific vegetative disturbance and chronic mental disorders under anxiety symptoms which are not regarded by the patient as a sign

of definite illness nor with indifference as is a brief hysterical conversion syndrome depression (which is well evident) and hysteria (individuals with shallow belief affectively and over dependence on others). Using this personality inventory we have scored 20 patients in the Service with disordered sleep and 50 controls matched for age and sex. Our control group did not differ significantly in any parameter from groups of normals from the United Kingdom Atomic Energy Authority (Crowe, Duggan and Howell, 1969) or nurses and medical students (Crowe and Croop, 1966) but there was a significant difference between disordered sleep patients and controls in their importance scores for the somatic consequences of anxiety controls mean 1.18 (SD 0.78) disordered sleep mean 4.96 (SD 0.88) (Fig. 1). Although the numbers in this series are comparatively small the evidence so far suggests that in terms of this personality assessment there is no significant difference between sailors and civilians but that sailors with disordered sleep are different from sailors who have no sleep problem.

It is equally difficult to assess the degree of stress created by operational conditions in the modern Navy. Thus the naval rating of today is more highly trained and has a more responsible job than his counterpart 25 years ago, more beyond dispute, for Wain (1971) in his survey of peptic ulcers



Fig. 1. Mean scores on the Maudsley 50 item questionnaire in patients with disordered sleep (hatched) and controls (white bars). (Mean for 50 of 100 questionnaire items was 1.00).

tion in the Royal Navy pointed out that the students are highest in military groups (Supply, Medical and Communications) and lowest in the science groups (Royal Marines) and the technical branches. This is a rather surprising finding since the last two groups are those in which most of our sort or master would be expected to be the most senior. He has suggested that job satisfaction, which is probably highest in the technical branches and in the Royal Marines, may be a more than adequate counter to the additional stresses in these occupations. In view of Mundy's findings it is tempting to speculate that his hypothesis, when given group data had been used, may have indicated a relationship between job satisfaction and job retention, but we hope it will provide us the means to test.

In summary therefore there is some evidence to suggest that patients with duodenal ulcers have different personalities and a different physical make-up in terms of gastric secretion than a similar occupational group who do not develop this clinical entity. There is at present no definite evidence that recruitment to the Royal Navy is selective in favour of an ulcer-prone group. It is to be hoped that further studies in this field will throw more light on this difficult but important problem.

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STRESS AND THE ENTERON

by R. B. Hunt, A. M. O'Brien and G. F. Nelson-Thompson

The multiplicity of names which have been used to describe the symptom complex now generally recognized as the variable bowel syndrome is an indication of the uncertainties that surround this difficult but common clinical problem. In recent years Mansfield (1964), Chandhary and Treloar (1965) and Gordon (1972) have published retrospective studies of their patients, while Walker and Mawhood (1969) studied 50 patients prospectively. Their results suggest that the variable bowel syndrome is a chronic relapsing condition more common in women than in men and with its onset usually before middle age.

Selection of Patients

In selecting patients for retrospective study we have adopted the criteria of Walker and Mawhood and only attended to the study patients with diarrhoea or alternating diarrhoea and constipation with or without abdominal pain for which no organic cause could be found after investigation. Patients who complained only of constipation were not included. Manual investigations, before admission to the study were sigmoidoscopy, barium gastro-erythrogram, adenoscintiscans and stool examination and human serum. Ninety-six patients also had human serum as well as stool chemical tests. Three patient biopsies, six rectal biopsies and one colonoctomy were carried out. Other investigations were limited to oral lactulose absorption tests and serologic complement fixation tests.

The Series

Adequate information was available on

56 patients, all of whom have been seen personally by one of us and as the majority of whom up to date follow up information is available. All were serving in the Royal Navy, the Royal Marines, the Women's Royal Naval Service or the Queen Alexandra's Royal Naval Nursing Service at the time of the onset of symptoms and all are still serving with the exception of two patients, one has been recruited and one left the Service at his own request. The age at onset of symptoms ranged from 18 to 31 with a mean age of 24.3 years. The majority of patients had had symptoms for under five years but four had had symptoms for 15 years or more, one of whom had symptoms for 21 years. No patients have been admitted to hospital although eight had had appendectomies. There were 45 males and five females in the series which comprised 14 officers and 32 ratings. It is of particular interest to note that 25 of our patients developed their symptoms after an acute attack of diarrhoea, and 24 of these were wrong altered in the time of onset of symptoms.

Symptoms

All patients in the series complained of diarrhoea, which they defined as an increase in bowel frequency above their normal habit. In 21 patients this was continuous and in the remainder intermittent or alternating with constipation. The stools were severely described as loose and commonly contained some recognizable undigested food. Nine patients had had some blood in the stools at the initial stages of their illness, all of these were

thought to have had an acute attack of dysentery.

Malaise was not a common feature of the illness of these patients and increased fatigue was complained of by 11. Diarrhoeal stools or abdominal pain occurred in 20 patients and the site of this varied from perianal to perianal although it was usually constant in the individual. Twenty-one patients complained of an exacerbation of symptoms at relation to particular stress of duty which varied from battle stress and assaults to evacuation and port. Twenty-two patients complained of gastrointestinal symptoms of which the commonest was a mixed weight loss but although symptoms preceded this was invariably reported. Tiredness and anorexia were also reported. Twenty patients acknowledged that their symptoms were aggravated by stress or complained of specific anxieties about Service or domestic problems. A small minority of these had symptoms that were considered likely to be purely anorectic. Fifteen of these patients had significant family difficulties which were commonly matrimonial but in one case involved conflicts with parents. One patient, who was ultimately invalided with a phobic anxiety state and a severe circadian bowel syndrome had a mother and younger brother who were similarly affected. Two patients had spent the previous three to four years all with officers except one candidate for a commission whose symptoms resulted in promotion.

Physical examination showed all patients on the whole to be in good physical health although tenderness was noted in one or both distal ileocaecal areas in seven patients. The patients' anxiety, stresses or preoccupations were commented on at the clinical examination time in 18.

Prognosis

Treatment was used liberally with Lamont (16 patients) Buscopan (seven

patients), Librium (one), or other preparations judged to be symptomatic therapy. Five patients were referred for psychiatric opinion. Thirty-eight of the 58 patients were either discharged on or around Medical Category F2 within three months. Almost half have been lost to follow up and these are still under hospital and patient supervision.

Discussion

These cases cannot be regarded as representative of the probably larger syndrome in the Royal Navy since a few are evidently from a highly selected unit. We have confined our studies to those patients in whom the extent of investigation justified placing them in the dyspeptic category with a reasonable degree of certainty. Nevertheless we believe the syndrome to be as common if not more so in Service life than in civilian practice and the symptomatology in our cases corresponds closely with other published studies. As might be expected in a Service population the post-dyspeptic group is significantly larger in our series (31 per cent) than in that reported from Oxford by Chantbury and Trueman (1962) who found 14 patients with a history of previous or persistent dyspepsia in a total series of 130 and Goughs (1972) who reported on one of 60. These workers suggested that the post-dyspeptic group carried a more favourable prognosis.

These findings are supported by the good prognosis that this disorder appears to carry within the Service and in the most encouraging feature of our study. Only one patient in our series had to be invalided and this because of severe psychiatric disability. All the remaining patients were able to return to general service in Category F1 and were found that their symptoms were more than an inconvenience.

Our study strengthens the impression

gained from previous studies that the variable bowel syndrome is not a specific entity but we suggest that the post-dysenteric variety is one type of the disorder which may relate to identity. Any attempt to discuss the mechanisms underlying this disorder can be no more than speculation. There is good evidence that abdominal motility throughout the gastrointestinal tract is perturbed in a number of cases of patients with this syndrome (Wolke and Mearns, 1987) but how this is mediated remains uncertain.

Wright and Das (1988) showed that rapidly ingested food increases in the area was raised in patients with nervous disorders and Ellis and Gordon (1983) have produced evidence suggesting that sensory-intestinal activation is raised in patients with the variable bowel syndrome in whom diarrhea predominates as a symptom. There are good theoretical reasons for supposing that abnormal activity in the smooth muscle of the intestine is a feature but Connell (1982) has shown that diarrhoeal states may be associated with over-inhibition of intestinal motility. In disorders it is possible that vasoconstriction, the polyphasic hormones of the gastrointestinal tract or prostaglandins may cause reversal of some fibres across the intestinal mucosa through stimulating adrenergic cytosol activity with the production of cyclic nucleotide AMP. While some patients with this syndrome undoubtedly have true diarrhoea in

nature, P. Schwartz is not dissatisfied with minor stool volume; it has been suggested that others have a normal total 24 hour stool volume in spite of his increased bowel frequency (Kammann, 1953) but our retrospective study does not provide any data on this point.

Summary

In summary therefore we conclude that the variable bowel syndrome is a syndrome problem in the Royal Navy and Royal Marines frequently follows adjustment to fluxions is often aggravated by stress but is rarely incapacitating. Although clinically well recognized the mechanisms underlying this problem are entirely unknown.

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STRESS AND MYOCARDIAL INFARCTION

by John F. Holliday and John F. Rivers

In 1948 Professor Willem Osler in his Lundbeck lecture to the Royal College of Physicians said:

It is well the different stresses people who is grown to engines, but for robust the vigorous in body and mind the least and unknown even the evaluation of where engines is always at full speed ahead. There is indeed a frame and fitness in most suggestive of engines, the well set out of from forty five to fifty five years of age with striking bearing, and they last and blood compliance.

In 1952 Osler suggested that the coronary pattern was a hard driving, goal directed individual whose considerable personality requires release in work, more social work, clubs and clubs (1953) has shown that there is a probable excess of coronary, managerial and planning personnel in the young coronary heart disease group. A causal relationship between occupation and coronary heart disease was put forward by Maier (1954) and Folstein (1955) and recent work has suggested that even within a particular occupational group there may be a significant difference in the incidence of myocardial infarction between different groups of workers (Robins, Hardy, Kettle, Roberts, and Parker 1955).

It was decided to investigate our population with a view to seeing whether there was any difference between them and the civilian male population, and to try and assess the effect of Naval service on the incidence of myocardial infarction. A retrospective survey was therefore performed of all cases of myocardial infarction occurring on the Royal Navy between 1952 and 1955. The criteria for the diagnosis were:

a typical history of chest pain, chest X-ray changes and typical alterations of cardiac enzymes. In addition we accepted only the group persons who had a confirmation of two of these factors. Using these criteria 110 cases of myocardial infarction occurred on the Royal Navy in these 4 years (fig. 1).

FIGURE 1

Occurrence of Myocardial Infarction

Officers	28	
Senior Rate	64	Technicians 29
Junior Rate	9	Non Technicians 40

110

Every rate from AB to CPO and every rank from Rate Limited to Vice Admiral was represented. Our youngest patient was aged twenty and our oldest patient was aged sixty five.

Of these 110 patients 29 suffered their acute infarction while involved in sea service. 77 were actually on board ship and 190 were known to be on leave. Fifty three had their attacks while engaged in shore service. There were 28 cases in whom even the date could not be ascertained, mainly because they were admitted to civilian hospitals and the necessary question was not asked. When we tried to relate these figures to a population base we were unable to do so because the population serving aboard varies greatly within a particular year and no figures are available from which to form the necessary base. However, the approximate ship to shore ratio is, say, 2 to 1 and therefore these data are unlikely to be a significant source of the attack.

rate of myocardial infarction, while serving at sea.

On a preliminary analysis of our data it became obvious that Petty Officers and Chief Petty Officers made up the bulk of the myocardial infarction victims, but there was a more even scatter of attacks among officers between the ranks of Lieutenant and Commander. Further analysis showed that this apparent discrepancy was explainable on the basis of age alone and no single group appears to be more liable to infarction than any other.

Attempts to analyse the effect of an actual job on the incidence of myocardial infarction were rendered virtually impossible by the confusion of the numbers.

The effect of a myocardial infarction on a person's future service was then examined. Twenty of the 118 patients returned to full duty. Of these one is still serving and 19 have left the Service in medical category F1. One third of these patients returned to normal duties and one third were avoided from the Royal Navy as a direct result of their infarction. Ten patients died. During the follow-up on those who returned to full duty only one patient suffered a further infarction and he is still serving in a reduced category. It should be noted that normally seagoing men are only allowed to serve in a reduced medical category for a period of eighteen months and only in special circumstances may they be allowed to finish their commission or engagement in that category.

Before trying to correlate these figures with those of the general population, the basic population from which these cases should be considered (Fig. 2) it will be seen that there is a totally abnormal distribution with its maximum point at the age of 34 and very notable losses at that age to 37 and least on at 38. A number but not nearly as marked graph appears in officers without a peak at age 25. To illustrate the fall off from officers' service at a later age



This results in the average age 34 of all officers being only slightly less than that of the Chief Petty Officers. The figures become significant from the age of 30 and the area of the population is therefore represented on a semi-logarithmic plot for comparison with the actual number of attacks (Fig. 3).

FIG. 2. Age at onset of myocardial infarction (Petty Officers and Chief Petty Officers).



This shows that while the population is more reasonably steady, the expected age related increase in the number of attacks



occurs. As soon as the incident begins to drop, the figures lose whatever significance they previously had. Comparison of these figures with those of the *Registre General* shows that there is a close relationship between the strike rate of myocardial infarction in the Royal Navy compared with the general population (Fig. 4).

Conclusions

Although these figures cannot be interpreted as demonstrably significant they do

appear to indicate that there is no significant difference between the incidence of myocardial infarction in officers or in ratings, between junior rates and senior rates, or between technical rates and non-technical rates. We are not able to make any statement about the significance of an excess with relationship to shore service.

We are thankful of the opinion that the times of a great improvement does not appear to affect the incidence of myocardial infarction. In view of the satisfactory results from this retrospective survey a prospective survey is being set up in order to further delineate any areas of difference.

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THE NOBIL DYE AND ITS SEQUELAE

by R. J. Shurin

As a pathologist entering the field of study of decompression sickness one of the first questions that I asked was "what is normal for the hyperbaric situation?" Study of the literature on decompression sickness revealed numerous reports of carefully controlled animal experiments covering a wide range of exposures to hyperbaric conditions. Data for man under similarly controlled experimental conditions is scanty.

In the context of decompression/sickness patterns cycles devoid of clinical signs or symptoms, it seemed questionable whether normal values quoted for man for a wide variety of biological parameters in static and static work at sea-level were all applicable to the hyperbaric situation. In the absence of basic line data for asymptomatic hyperbaric exposures it would be difficult to interpret values measured with great maintenance of decompression sickness and therefore impossible to determine their significance relative to the condition of the person.

It was, therefore, decided to set up a series of experiments on man using a dive profile which in the experience of my colleagues had never produced any signs or symptoms of decompression sickness either under simulated conditions or on the sea. The dive profile that was selected was an exposure under simulated conditions to 180 ft of seawater on compressed air. The ascent time for this dive was 2 hours with a bottom time of 1 hour. This fitted into the working day and the personnel concerned were roughly ten pounds more than those experienced on the construction of the Dyle. Tantalum lines which a considerable

amount of data had been obtained.

The chamber conditions were carefully controlled during the dive, all subjects were at rest in the chamber and in order to obtain basal levels the blood was collected under fasting conditions.

The first dive involved eight divers from a ship which at that time was undergoing refit, and one of the parameters which are decided to study as an extended time scale was that of the platelet level. Although normal experiments and some human trial age indicated that after prolonged or very severe exposures a platelet depression had occurred, reports indicated that there was no change in the platelet level after a normal exposure. The specimens on these instances had been collected immediately prior to and after the dive exposure (Fig 1). The results of this experiment showed that a platelet depression occurred following the normal sea dive and reached a minimum on the third day after the dive. A statistical analysis of these figures by students *t* test revealed a significance on day 2 post dive of 0.01 and on day 3 of 0.021.

This pattern of depression occurred later for Fig 2 shows the results of three and



Fig 1. Individual variations in platelet counts in the diving air after and following four dives.



Fig. 2. Plasma volume (ml/kg) plotted as a function of time (days) for 10 subjects.

from (1966) studying patients following trauma and the most type of pattern of response can be seen. It had previously been considered that the plasma in the post-traumatic situation had been released as the clotting mechanism following a traumatic accident but in the context of what was regarded as a perfectly normal sea dive in which there was no evidence of injury a water piston accident. The possibility that some degree of micro-injury at a cellular level had occurred could not of course be excluded.

Another possibility considered was whether this phenomenon was due to the actual change in pressure or alternatively whether it was related to some type of performance response to the situation.

A further series of experiments were designed to differentiate between the latter two factors by including a negative control group and also by comparing divers with non-divers to see whether any differences which might be attributed to pressure arising responses could be isolated.

It seemed unlikely that plasma would be the only factor to be affected. Various

authors have implicated the nervous system and coagulation factors in decompression sickness. An aim from each of these groups has been selected for presentation.

Follow-up volunteers were obtained and divided into 3 groups. Group 1 was composed of five recently qualified divers. Groups 2 and 3 were each composed of five men who had never been diving or in any other hazardous situation before. Groups 1 and 2 performed the simulated dive. Group 3 emerged from the chamber under the impression that they had completed the dive when in fact during the simulated decompression phase the main exhaust valve had been left open. This was our control group for the situation. In order to obtain a satisfactory base line, blood was collected by venopuncture for two days preceding the dive, on the day of the dive and for a post-dive period of four to 12 days depending upon the parameter which was being studied.

Figure 3 shows the results of the plasma studies. The group at the top are the experienced persons who emerged from the chamber under the impression that they had completed a dive when in actual fact they had not and shows the daily mean values of the plasma counts for this group. Counts were decreased after the fourth



Fig. 3. Daily mean values of platelet counts for each group.

day as there appeared to be no significant change. The other two groups are those of the experienced drivers and the previous who had never been exposed to hyperbaric pressure before. Again we find a maximum depression on the third day and the difference in the degree of depression between the two groups is not statistically significant. These were followed over a further period as it was curious to see whether the abnormal phenomena noted in the post-traumatic situation occurred in the situation and as can be noted present at all is assumed. The findings indicate that the depression is a true effect of pressure and not a psychosomatic response to the situation.

Eye Studies

No significant change in refractive behaviour groups was noted with regard to its glyceride or cholesterol levels, although Harada (1971) reporting on diving to 300 metres observed very distinct triglyceride increases such as occurs in certain cases of fat metabolism.

Changes were however apparent in the levels of unsaturated or free fatty acids (FFA) (Fig. 4). The negative response in the group 3 subjects indicates that the mechanism of mobilisation of this material did not have a psychosomatic component. Both groups performing the dive showed a marked rise in FFA's greater in the trained divers than the non divers consistent with increased lipolysis over and above the actual energy catalytic needs. It is not felt that any alterations should be drawn from the apparent high level of free fatty acid in Group 1 substantially prior to the dive, without further substantial evidence on study of the individual divers showed that three members of the group exhibited a rise above the previous two days levels and two members a fall. Nevertheless it

UNSATURATED FATTY ACIDS

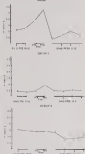


Fig. 4. Daily mean values of unsaturated fatty acids for each group divers, FFA.

cannot help feeling that the probability exists that with training a degree of metabolic alteration may be acquired.

Visual

Figure 5 depicts the values for plasma cortisol and is also indicative of metabolic change measured with compression/decompression cycles. Vaughan et al (1963) found that urinary cortisol levels followed a similar pattern to that of the plasma, namely exhibiting a peak in the morning which falls as the day progresses. A similar

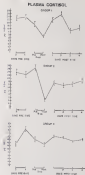


Fig. 2. Daily mean values of plasma cortisol for each group during 544h.

plasma cortisol for the time studied as seen in the control group 3. Both groups, who dived showed, a much greater fall (rise) in cortisol in the second dive, than in the second dive, during the three hour period in the chamber. It is possible that this fall (rise) at two stages is a response of increased resistance rather than a decreased output from the adrenals, as a marked rise in the urinary level of the reduced metabolite during simulated dives was noted by the

rest and Group 1 (FCG). The rise in free fatty acid and the fall in cortisol in the compressed/decompressed groups is means of the normal values obtained in the control group indicating that pressure influences the response.

Discussion

In this study the results of the Cerebral Phospholipase (CPK) intervention depicted in Fig. 4 are of interest, that material being an intercellular enzyme. Two members of Group 1 showed levels well outside the normal limit prior to the actual dive and continued to fluctuate above the upper limit of normal during the course of the experiment in contrast to the other three members of this group who maintained a normal level throughout. It was possible to repeat the observations on one of these divers under similar conditions some weeks later and it was found that he maintained a level below the upper limit of normal during the test period. These findings suggest a random effect from the factor variation in the period which had reverted to normal.

It would seem likely that the reaction producing this effect is a part of the diving procedure as shown by the results of the compressed subjects in Group 3, all of whom show a tendency to a rise of varying degrees on the third post dive day. Apart from an isolated high result in one subject on the second post dive day the results of Group 3 indicate the CPK elevation noted above are a true effect of the compression/decompression cycle although there appears to be considerable variation in the individual response.

Wright *et al.* (1971) studying the effects of barbiturate poisoning used a CPK rise which they attributed to abnormal muscle cell permeability with a subsidiary period of two to three days similar to that seen in the Group 3 divers above. During the course of a prolonged dive to 600 ft. 1440m

[CHANGE] PROFOUNDNESS



Fig. 6. Daily individual values of routine plus plankton for members of each group.



Fig. 7. Group 2. Change in profoundness during a 100 day exposure to bottom oxygen levels 7.5/100.

et al. (1971) reported a rise in the level of CPK.

This rise coincided with compression and reached a peak while at maximum depth on approximately the third day (Fig. 7). This seemed to normal while they were still at maximum depth and no further changes were recorded either during decompression or the post-dive period. This suggested that the rise noted at the nervous divers on the third day was precipitated by the compression side of the cycle in which they were exposed.

Compaction Fusion

The thrombus and thrombus degrades test products which were initiated by my collagen (Dr Clark and Clarkson at Edinburgh) showed no change in any group throughout the experiment. This is of interest both from the viewpoint of the previously described platelet depression and from the results of the myoglobin (see next study) tests. Wells *et al* (1971) reported a rise of myoglobin (see activity in decompression sickness in dogs.

All groups showed a similar response during the course of the dive indicating that this was not an effect of the decompression/decompression cycle but a psychosomatic response to the situation (Fig 6). Alterations in the myoglobin (see test in event of decompression sickness should therefore be interpreted with caution.

Wells *et al* (1971) decreasing the resistance of CPG circulation in relation to a local unit, suggest that there depression in the micro-circulation might give rise to retinal and optic damage with consequent release of intracellular myoglobin. Similarly the enzyme release may initiate platelet aggregation and produce fibrin deposition. The loss of the platelets which have disappeared from the systemic circulation has yet to be demonstrated but an indication is given by the work of Polp *et al* (1971) who reported evidence of an

increase of thrombus degradation products and a parallel depression in association with a symptoms producing simulated dive. This implies a certain degree of evaluation of diving trains the real products of which are presumably located in the micro-circulation. The cumulative effects of changes of this nature associated with speeds of re-pressurization of the micro-circulation may well not be acute but the ultimate development of major sections of bone over, in the course of a history of local symptoms.

Subjects

In Fig 4 it was shown that two of the named divers appeared to have CPG levels which were far exceeding well above the upper limit of normal. It therefore seemed prudent to look into this further. It was decided to follow the level of this substance during the next course of training and specimens were collected on weekly intervals. In this series we were unable to get the 14 men (before they had completed an usual bottom dive during the first week. However (Figs 9 to 11) show the time interval over which we got a change in the level of this substance in the blood serum and the variation in the response of the individual. It can be seen that the maximal response occurs during the first four weeks of trial (not exposure to pressure and at that time the maximum depth for the exposures was approximately 20 ft).

The first subject, F, is of note claimed as he decided that he was no longer able to go onshore with the course. When he was asked about this he was unable to give any explanation other than that he felt some thing was wrong.

Figure 12 depicts the computerized results for the group during the standard series of the course. This experiment was repeated and Fig 13 shows the group response. The major differences between these two courses were the climatic conditions prevailing. The first was in winter with a water temperature



Fig 8. Daily mean values of myoglobin (mg/dl) with 10% error bars for each group.

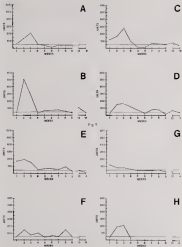


Fig. 10

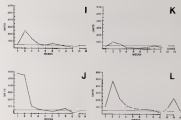


Fig. 10

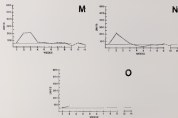


Fig. 11

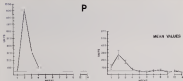


Fig. 13

Fig. 13. Effect of varying dose of Phospholipase on change of surface phospholipase temperature. Final figure is plot mean value and EMF for the group.

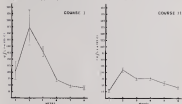


Fig. 14. Weekly skin temperature within phospholipase dose and EMF for seven consecutive Winters I and mean values of course II.

between 3°C and 4°C and the second in summer with a water temperature between 21°C and 24°C, thus probably reflecting the effect of cold. To confirm this it was decided to test again the following winter by using the following temperatures. It was found that conditions were more like those

of an Indian Summer and the results obtained for the group are shown in Fig. 15.

The first week of practical instruction resulted in a rise of CRP, similar to that seen in Course II between weeks 1 and 2. At this point an outbreak of a cold was infection brought about, leading to a period



Fig. 1. Change in heart rate over 10 weeks (change in heart rate due to effect of 100% point of training caused by a test pulse rate).

beat and the group CPR level fell to the upper limit of normal. When test group training was resumed approximately 10 days later a further rise in CPR level is noted but a rise of a lesser magnitude than the first response suggesting that whatever had been suspended initially had not been completely lost during the 10 day break in training.

Whether or not these observations will help in identifying individuals who are either physiologically susceptible for hypoxia, have work or who may become so with advancing age and experience will require long term study.

Summary

The results show that in terms of a normal sustained drive a number of covert factors are operating at subconscious levels. Freely used and stored changes indicate a metabolic influence. Respiratory type (one change point) to a psycho-vascular response to the situation. CPR, otherwise would

appear to be related to the subconscious side of the cycle and cerebral effects of stress during experience may be attributable to the dynamic patterns observed. It is agreed that type of background of subliminal training which reflects a normal brain has range of automatic and delayed effects that the changes relevant to decompression sickness are superimposed.

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VENOUS INFARCTION OF THE SPINAL CORD IN DECOMPRESSION SICKNESS

by D. H. Eiler, J. M. Hallenbeck and A. A. Berry

While in many divers there is a negligible incidence of decompression sickness or some categories of any illness divers it may cause what as many as 30 per cent of divers (Eiler, 1971). Decompression sickness can be considered as the illness which follows a reduction of environmental pressure sufficient to cause the formation of bubbles in the tissues. Recompression has remained the primary treatment since it was introduced in 1894 by Nott (Hall 1971) and the rapid response of acute decompression to recompression is well considered as supporting evidence for the presence of bubbles. In a review of the efficacy of recompression Workman (1969) stated that 24 per cent of those treated for decompression sickness failed to respond and some 17 per cent were left with substantial residual injury. Recompression is thus not as effective as might be wished, particularly in cases with neurological manifestations if there is delay before treatment is begun.

The conventional view of decompression sickness would involve the neurological damage to arterial bubble nuclei (Boydell, Dammert and Hallenbeck 1968) a hypothesis supported by their observation that the arterial supply is relatively spared in the deeper regions of the white matter of the cord (Boydell and Dammert 1968). It is also possible that poor perfusion there could facilitate a rapid growth of venous, long bubbles from the dissolved gases in the regions of the cord and cause the bubbles to lodge.

However, for several systems the brain should be the part of the central nervous system to be predominantly affected by

arterial bubbles. In stroke-like disorders such as subarachnoid haemorrhage in non-divers and small strokes of the brain stem the brain is a major target organ whereas the cord is not. Indeed, a personal of current histological and neuropathology demonstrates that most authors refer to arterial embolization of the spinal cord only in animals but the lesions of decompression sickness. Secondly arterial bubble nuclei are distributed according to their relative frequency (Van Allen, Hedberg and Clark 1970). This accounts for the dominantly distal manifestations of arterial air embolism following decompression pulmonary barotrauma. Embolism might therefore be considered to predispose to cerebral damage in divers who decompress sitting or erect. Furthermore with the poor proportion of grey to white matter roughly the same in brain and cord the brain possesses more 94 per cent of the human CNS with 60 to 70 times more blood flow than the cord and the brain would thus be exposed to venous pre-eminently more of any cerebral emboli.

To explain the dominance of spinal cord lesions in acute decompression sickness we have adopted a different hypothesis which begins with the symptomatic intervertebral bubble. Subsequent reduction of the lungs leads to changes in intrathoracic pressure which impair venous return, both the typical venous return from the thorax and the venous return from the legs. This leads to an obstruction of venous drainage of the cord which together with a generalized increase in blood viscosity, spontaneously produces regional infarction of the spinal cord.

intravascular bubbles are known to cause death in apparently safe decompression rates of divers who develop no symptoms on signs of decompression sickness (Spencer, Olson and Oysang 1971; Spencer and Campbell 1972; Frome, Burns and Wolfson 1972). In addition to any mechanical effects that these intravascular bubbles might cause in vessels and by extension it is known that they can exert indirect effects due to cellular toxicity. A 40 to 100 Angstrom nose of diacetylmorphine causes a rise in the blood-gas interface and tends to stimulate the exposed glomerular processes such that their hydrophobic groups are in the blood while their non-polar groups protrude into the pericardial space (i.e., Kurokawa, Finkelstein, Holgado and Meloney 1966; Lee and Harrison 1971). The resultant disruption of the secondary and tertiary configuration of these proteins causes an increased functional alteration. Thus, surface activity of the intravascular bubble while the diver possibly remains symptom free, can lead to platelet release reaction and aggregation activation of the haemostatic mechanism and hypercoagulable coagulability release and activation of vascular substances and cell clumping intravascular plasma from exposed blood directly, interference of nerve and ion output, deterioration of proteins and the formation of liquid crystals from lipoproteins (Lilburn *et al.* 1966; Lee *et al.* 1972).

The activation of Hageman factor is one important pathway in these possible events and would lead not only to hypercoagulable coagulability and fibrinolysis, but also to the activation of kinins and the complement sequence (Ratnoff 1967). We studied the effect of bubbling in vitro upon the activation of coagulability in whole blood and cell-free plasma. Samples of whole blood were divided into three aliquots and given three identical simultaneous treatments for 15 minutes. Cell free plasma was also divided into three aliquots and given three identical

treat and simultaneous treatments for 15 minutes but only after diluted plasma had been added as a source of physiological. One aliquot was bubbled and exposed to a partially evacuated, nitrogenous cylinder. Another was only agitated in a submerged syringe from which all bubbles had been expelled. The third was exposed to glass. Low White clotting times were then run consecutively on reference tubes on each of these aliquots. These clot times (Fig. 1) illustrate that bubbles in whole blood or plasma clotting were more than three as potent to plasma than much more than agitation alone in the cell free plasma. Additionally, though less dramatic, it still presents an comparison to agitation alone. That on separation of the bubbles and only agitate are clotting by plasma aggregation but also activates it in the absence of platelets by the activation of Hageman factor.

The many possible effects of bubble mechanical activity include those on blood platelets, viscosity, fibrinogen, and color haematological values. It is possible that a delayed depression of platelets following apparently safe dives (Olson and Nichols 1972) is a manifestation of the presence of symptom-free bubbles which themselves can be detected for some days, to four days after a dive (Spencer and Campbell 1972).



Fig. 1. Aggregating components in whole blood and plasma. Effect of bubbling and agitation on plasma.

A series of dives was performed on awake, unanaesthetized monkeys both intact and splenectomized from which some representative values are illustrated (Figs 1 and 2). Whereas the plasma samples showed gross and early deviations from normal there was no great difference in the haemoglobin indices between a surf dive and one that caused a 'lung break'.

Haemorrhage is a known complication of decompression sickness (Crosby and Robinson, 1966; Brumer, Fink and Robinson, 1969) but its true extent has

not previously been determined. Plasma and red cell volumes were measured in deep-sea divers by a single injection of ^{51}Cr -labelled albumin and ^{51}Cr -tagged red cells. Haematocrit increased from 34 to 46 per cent and plasma volume decreased in periodic animals. Control animals and divers exposed to surf dives and to dives which produced lung breaks showed no such change. The red cell volume remained constant in all dives. Thus the haemorrhage, including desaturation volume, is due to a loss of plasma into the extravascular space.

Ultimately bubbles enter the larger veins and are swept to the lungs. Consequently upon a sufficiently large population of intravascular bubbles arriving at the lungs, it is probable that there is a mechanical and osmotic increase in pulmonary and vascular resistance (Lohn, Allardy, Sotomura and Bore, 1972) leading to some interstitial oedema (Gordon, Poon and Fregman, 1972). It seems feasible that the response of the lungs to intravascular gas will depend on the rate of arrival of the emboli. Thus a few bubbles may lose their gas by excretion through the lungs; a few more may drain into pleural or peritoneal cavities; a large number may lead to a rise of pulmonary artery pressure, some bronchospasm and an increased amplitude in the cyclic range of intrathoracic pressure during respiration.

In otherwise unobstructed animals, pulmonary artery systolic pressure, pulmonary artery diastolic pressure and right ventricular pressure rose at the same time that bronchospasm and re-degassing became evident. Subsequently central venous pressure rose accompanied by a disproportionately large increase in thermal power. Shortly thereafter signs of spinal cord damage appeared. Cardiac lesions were revealed by ex vivo rigidity, loss of cardiac reflexes, loss of parasympathetic reflex and occasionally by disorganized parasympathetic respiratory arrhythmia. Continued spinal fluid pres-



Fig. 1. Changes in (a) arterial blood volume (ml), (b) plasma volume (ml) and (c) red cell volume (ml) during a surf dive and a lung break dive.



Fig. 2. Changes in (a) arterial blood volume (ml), (b) plasma volume (ml) and (c) red cell volume (ml) during a surf dive and a lung break dive.

CHANGES IN AZYGOS-VERTEBRAL VENOUS FILLING PATTERN AFTER
DEVELOPMENT OF CHOKES IN A CHLORALOSE ANESTHETIZED DOG



B CONTROL - NO CONTRAST

RVC - RIGHT VENTRICLE
CATHETER

AC - AZYGOS CATHETER

AC - AORTIC CATHETER



B FIRST AZYGOS INJECTION

$A_{AP} = \frac{100}{100}$

$Q_{AP} = 11$
ml/min

$Q_{AP} = 8$

$R.A. = 100$

$R.A. = 87$



C FIRST AZYGOS INJECTION - 100/100 AT 40° IN
THE CHOKED DOG

$A_{AP} = \frac{110}{100}$

$Q_{AP} = 12$
ml/min

$Q_{AP} = 27+100+107$

$R.A. = 80$

$R.A. = 48 \pm$ ASSISTED
RESPIRATION

Fig. 4. Left from a 14 cm source a graph of A_{AP} is obtained along 1.5 cm \times 1.5 cm in the region of $A_{AP} = 100$ as an indicator.

in a few seconds before the onset of the neurological deficit and returned to pre-painful values during the next 30 to 45 minutes. The inhibition or absence of reflexal autonomic response, in all observed intubations and lung inflation which were normal practice suggested, after the onset of spinal cord damage, an obstruction of the epidural venous system.

The epidural venous system, i. e., a large inferior vena cava receiving many of paired venous trunks extending from skull to sacrum within the spinal canal (Hansen 1946, 1951). These trunks are situated at each intervertebral foramen with the ascending lumbar vein, in the abdomen, with azygos and hemiazygos veins in the thorax and with the vertebral veins in the neck. They connect with the cranial third venous via the vertebral venous system. They also communicate with the posterior bronchial veins and the paravertebral veins.

Studies were made in unanesthetized animals of venous dynamics during acute decompensation induced at Duke University where cinematography is possible in the compression chamber at rapid external pressure. Azygos cinematography was also supplemented with pneumocinematography. Both techniques demonstrated changes (Fig. 4) of flow patterns after the onset of neurological decompensation, indicating increasing apparent obstruction of parts of the vertebral venous system in painful dogs.

Shortly after a painful dose, other dogs were given intravenous Evans blue, a vital dye that becomes bound to the plasma of blood. This complex is normally excluded from the CNS by the blood-brain barrier but where this becomes damaged the dye is retained in analogy by a blue staining. It was found that the area of CNS damage was in close agreement with those produced by previous clinical examinations. In a

series of 35 animals all had spinal cord lesions, one had brainstem lesions, and most had distal involvement. The animals were greatly hemorrhagic and gas distended in the white matter. This together with the spacing of the gray matter forms the typical picture not of normal but of venous infarction of the CNS (Hansen and Parsons 1957). Examination by telegraphy and with a scanning electron microscope confirms the presence of venous congestion and pressure in thrombi in the cord and nerve roots. Description of the spinal ligures in the cord was also made.

In conclusion therefore, we have advanced the hypothesis that paraplegia following decompensation is due to cerebral bubble emboli in focus at one in which surface activity at the blood-gas interface of the microvascular bubble leads to platelet aggregation and Hagman factor activation initiating in turn the release of biologically active amines. This is especially so in the lungs where hemorrhages and increased intrapulmonary cyclic pressures can lead to stasis in the epidural venous system. Together with a degree of haemocoagulation and an increased viscosity due to hemagglutination from this stasis the macrocirculation of the brain stem and spinal cord particularly susceptible to slow bubble growth and thrombosis. Even without any animal bubble content we believe that these factors are sufficient to account for spinal decompensation syndromes which we consider to be not an animal but a venous collection of the brain stem and spinal cord.

Note

The opinions or statements contained herein are the private ones of the authors and are not to be construed as official or reflecting the views of the US Navy.

The animals used in this study were handled in accordance with the provisions of Public Law 89-64 as amended by Public

Line W-178. The Annual Welfare Act of 1970 and the principles outlined in the Guide for the Care and Use of Laboratory Animals. US Department of Health, Education and Welfare Publication No. (DHEW) 78-0012.

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THE EARLY DIAGNOSIS OF DECOMPRESSION SICKNESS

by J. Vannote

This note is somewhat misleading in that the early diagnosis of decompression sickness depends entirely on when the diver chooses to report that he has symptoms. In the case of most animal experiments the endpoint is even more gross and usually in the form of severe paralysis or death. These are clearly unsuitable end points for investigations of decompression theory or testing decompression schedules. Indeed, since decompression is designed to prevent decompression sickness, the end point should not come in experimental diving. What we really need then is a method which will predict, prior to any clinical signs or symptoms, that unless something is done to prevent it decompression sickness will occur.

In 1963 Mackay reported his success in using ultrasound in detecting bubbles in rats during decompression. Since then, he and other groups of experimenters have investigated the different methods available for electronic detection of bubbles and have attempted to refine these methods. It was and is still hoped that successful application of ultrasonics could lead to a better understanding of the etiology of decompression sickness and thus enable the development of optimal decompression schedules to detect when bubbles might possibly be detected and used as an endpoint for decompression adequacy during a dive. It might also be possible to correlate observed rates of pain with findings of actual developing bubbles, and to answer one of the important questions in diving.

Various ultrasound techniques have been used to try to achieve these ends. One of these, acoustical optical imaging, I can

not only for the sake of completeness. This system uses ultrasound and a laser beam. This is a complex apparatus method which is also unsuitable at present because of the high noise levels encountered (Buckley and Kern, 1966).

The poked-into method has been used to detect bubbles successfully in animals and men during decompression (Mackay and Ralston, 1963; Ralston and Mackay, 1971; Hughes, 1968). This method will detect satisfactory and nursing bubbles as small as 3 microns in diameter. It does, however, require a sophisticated sound display system including some form of recording so that the pattern of any one test can be compared to patterns at another time. The echo pattern is also extremely sensitive to movement of either the transducer or the subject. These two disadvantages greatly decrease its usefulness outside controlled laboratory experiments.

Another version of ultrasound which has been used is that of through-transmission in which a sending transducer is placed opposite a receiving transducer so that the ultrasonic beam passes directly through the animal under investigation (Gibson, Hargrove and Weiss, 1973; Powell, 1971 and 1972; Walker, Evans and Hopkinson, 1968). This method will also detect nursing and satisfactory bubbles and the circumstances are fairly simple. The chief hindrance is that the subject must remain still.

Doppler ultrasound has been the method employed by most investigators to date (Evans, Bernard and Watkins, 1973; Noble, 1972; Powell, 1972; Smith and Spencer, 1973; Spencer and Campbell, 1968; Spencer

and Clark (1971). The apparatus is readily available and it is used in clinical practice. Experiments with this method have indicated instantaneous monitoring as well as monitoring major blood vessels with a cuff type instrument. This mode of bubble detection has two drawbacks. The first is that it will not detect stationary bubbles. The second is that characteristic of the doppler signal is very diffuse because the frequency is influenced by the rate of blood flow and by the angle at which the bubble is approaching or receding from the transducer. The best application of doppler ultrasound would seem to be in monitoring bubbles in large vessels since the bubbles will always be passing the transducer in the same area. Obviously the application of cuff transducers is one of the questions in humans.

Unfortunately the early hopes for ultrasound as a method of processing decompression have not been fulfilled. The one valuable result from this research is the confirmation of silent bubbles occurring during decompression. These are bubbles either circulating or stationary which do not cause any symptoms of decompression sickness and were suspected to must be worst investigators. This finding also casts a good deal of doubt on the theory that, in all commonly used decompression tables that most gas can exit in super-saturated solution in the body. Although these bubbles can be detected they have not led to the point of using them as a guide in the adequacy of decompression schedules. There is no correlation in the numbers of bubbles found and subsequent decompression sickness for that. All of Doppler ultrasound has not been used successfully to see bubbles and in fact the commonly used doppler detectors cannot detect bubbles much smaller than 100 microns in diameter by about bubbles 10 microns or less in diameter which are the size which can pass through a capillary bed. Another pro-

blem with the doppler method is that it will also detect air aggregation in micro-circuits which seem to complicate the analysis of the signals (Fried and Linschoten, 1971). None of the methods has provided any information relative to the rate of formation of bubbles and the location of symptoms.

The great drawback common to all methods is that only a tiny portion of a human body can be monitored. The signals from this area bear no correlation at all to what is happening elsewhere in the body. If the cuff type doppler method is employed based from large portions of the body can be monitored but this does have the ability of detecting stationary bubbles which may be causing symptoms and also monitor the possibility of detecting the point of origin of the bubble. This latter possibility is also lost with some extensive-doppler detectors as they do not pick up stationary bubbles.

All the methods also are handicapped by a lack of a simple rapid processing system which operates at real time. Some interesting work which may prove useful is being done on frequency spectrum analysis of doppler shifts caused by bubbles.

With all these problems it is evident that present the only method which shows any potential for being useful in managing and predicting decompression sickness. Perhaps in the future we will have a system incorporating a rapid whole body scan not requiring attachments to the diver with a simple protocol to tell us when and how to alter decompression. Until that time we are still reliant upon the diver reporting symptoms to make the diagnosis of decompression sickness.

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STRESS AND THE NAVAL CHILD

by A. W. Sankillem

Introduction

Interest in the Naval child and the stresses of his environment was aroused when I was working with Dr Peter Matheron in the Helsinki Child Guidance Clinic at Helsinki. At that time it seemed to us that (Navy) children had a relatively high cultural rate to a Child Guidance Clinic, referred to the Finnish coast being in the order of some 11 per cent of all referred cases. Two particular areas of stress were identified — that of masculinity of boys and education, and that of social instability caused by separation. An attempt was subsequently made to evaluate the effects of separation in a longitudinal study. A group of Naval children was to be compared over a period with a control Navian and civilian population. The initial survey was completed but the longitudinal aspect of the trial was thwarted by the ship becoming unseaworthy and therefore the separation period not occurring.

The survey in this paper is of a Finnish Navian population in Singapore and a comparison made 217 children who were engaged by the psychiatrist during a 24 year period. Straight forward educational and social problems were excluded from the study.

Review of Literature

Matheron (1959) identified three problem areas relating to the Navian child. Family problems resulting from mobility, vocational problems resulting from separation, and identity problems resulting from male personality traits. Literature in the last two areas will be reviewed.

Separation

Hornell (1959) identified long periods of paternal separation in a navalized group when compared with a control population. He also termed the relative neglect of father in the literature, stating that poor inadequate mothering, a child could be very dependent upon the father — the father being therefore a key individual in a child's life.

Tyler (1955) compared Norwegian sailor families with appropriate control families. He identified the following characteristics:

- a. dependency
- b. preoccupation
- c. over substitution of the father

He attributed this to the deprived maternal attitudes of the mother in her tender her social and work withdrawal and her over protection and over controlling of children. This tendency to dependency which he noted could be seen as consistent with our findings of the parent divorce of menages in our own land.

Lynn and Serway (1955) made a prediction of the effect of father-absence on boys. They concluded that three hypotheses were largely supported by their findings. They suggested that absent children would be

- a. immature (and sensitive)
- b. Would over identify with father
- c. They might over compensate in masculine role-playing
- d. They would have poorer peer relationships
- e. Finally, they would become more mother-dependent.

Pfeiffer (1944) surveyed the literature and suggested that in disturbed children two hypotheses might be suggested. Firstly, severely disturbed male children could be predicted to have histories characterised by relatively longer periods of father absence; secondly, within the disturbed and normal groups, the extent of father absence in a child's history was predicted to be positively related to the degree of emotional disturbance the child shows. He made the theoretical postulation that separation in the oedipal period (1 to 5 or middle childhood) could be significant, but he suggested that evidence was lacking in his study to count them as significant differences in separation experiences between the ill and the control group. However, in the most significant group there was a clear cut onset of relationship between the total period of separation and the degree of maladjustment. In the normal group there was no significant relationship. He could find no specific age period. The significant finding appeared to be that the mothers of the disturbed children were significantly more disturbed than the mothers of normal children. No relationship was found in the fathers. He suggested that maternal behaviour had a meditational effect upon the child's reaction to father's absence.

Claborn (1960) found that reports on periods shown by a behaviour disturbed group were significantly longer than the controls. This was particularly so in male children as the only child or the only boy in the family. She emphasised the importance of how parents played their parental roles. Royal fathers and over-protective mothers were singled out. Her conclusion was that separation only acted in a significant sense if there were existing family problems.

The role of the not mother has been examined by a number of authors including Brier (1942) and Kegan (1957).

Brier (1942) studied the parents of a

100 disturbed children in a Service Child Psychiatric Clinic. Of these he showed that 37 had been treated for psychological symptoms and a further 30 had given no psychiatric consultation.

The children of mothers with a positive history were found to have more severe separation anxiety and more severe delinquency. Relationships between the maternal disorder and the child's disorder were noted. It was particularly noted that the women with personality disorders more often had severely disturbed children than the psychotic or depressive mothers. Fagin (1967) described the absence of the father as a stress state likely to give rise to a variety of behaviour patterns. In our study relatively few mothers were disturbed, in any direct way in this study.

Lyon (1967) described three critical phases in the separation state before, during and after separation. The Naval schools in Singapore were closed at this possibility. No significant disturbances were noted in the separation group at risk. There were the children in submarines and adverse circumstances. A similar study to that attempted in Plymouth was proposed but again logistic difficulties prevented this longitudinal study.

Section III — Mobility

Claborn (1960) varied the social distance between Service and civilian children in the United States. While not joined in the same mass environmental context they were also exposed by various physical and social situations characteristic of Service life. Physical amongst these were the many moves which caused changes for the child at home and school, neighbourhood and friends. She regarded these moves as being important in the home child/parent relationship. Matthey (1969) in his study also appeared to indicate that the child's reaction was probably secondary to that of mother.

However, Bower (1967) quoting a colleague in Washington suggested: 'Living experiences which are isolated out of a series of treatments or experiences of such experiences may produce a reality of self which is experienced as anomalous and unresolved. Such self-concepts undoubtedly lead to perceptions of consciousness as optional stop-overs on the way to the final situation. He indicated that such awareness could be a potential cause of psychiatric disorder. Another problem identified by the same author was the 'internal syndrome' to which an alienation with a consistent pattern of the 'guilt complex'. This describes the life situation of many two-parents with large families isolated from potential support living in a mass community as the mode of a class population. This is not in the Serres' description where families are unemployed, not only in foreign countries but also in large parts of the United Kingdom. Cultures are widely at variance to those experienced in the parental home.

David and Elliott (1966) have suggested that the stress imposed by a culture shock situation is such that a family's potential to cope should be more fully assessed before they are exposed to such exposure.

Kenny (1967) suggested the reality as a selective community. Fathers having been subjected to certain gross observations of personality and conduct. He indicated that this reference would help the development of social movements which might otherwise be more prominent.

Types of Emotional Disorder

James and Cordes (1976) study compared the relative incidence of psychiatric disorders in British and American children by sampling a series of communities, even in both classes. Our study was compared with this in general terms. Regarding descriptive characteristics direct comparison was difficult. James and Cordes

(1976) noted that it was difficult to compare results due to different diagnostic criteria. Our figures were seen to match in broad terms those of the British Serres population in Germany.

Kenny (1967) compared children, visiting American Army Child Guidance Clinics with reports from clinics in the United States. He stated that the American Serres child was more anxious and less delinquent than his British counterpart. This impression was accepted by Benton (1969) as being similar to his own experience. Our own study helped to explain this impression.

The division into anxiety or neuroticism or accepted by many authors as being a legitimate expression of disturbance. It is suggested that once established as child faced these broad categories present somewhat life situations the individual suffers or whether he reacts others to suffer' (Pridmore and Graham 1968).

It has been suggested that disturbance follows a cultural pattern. It has been suggested that the Serres population is selected and that delinquency is largely selected out amongst the parents, thus reducing the cultural delinquency factor. Alternatively it is suggested that Serres subconsciously of discipline prohibits taking out behaviour of a delinquent nature. This latter is also blamed for the interrelationship of teacher and the production of children.

Bower (1967) described the unique position of power of the individual child in a Serres family. This Bower describes as being assessed consistently as unconsciously through the knowledge that a child must meet his/her problems on the part of any one in the family and does much as the whole family being experienced and can ultimately affect the father's career. Examples of this were noted in my class sample in Singapore. Conversely, over-protective of this power may well result in the lower delinquency rate which actually

ment in Service families showed when compared with that described by Matthews (1968) at home.

Background to Present Study

The Clinic was started by a post-war psychiatrist, a full-time educational psychiatrist and a paediatrician, small number. The team was primarily responsible for the Service children in Singapore Island and in Malaya, although they acted as a consultation agency as far away as Hong Kong. The population of this study is confined to Singapore Island. This population consisted of 10 600 children, broken down into the categories as shown in Table I. In addition, there was a seriously un-manned region of pre-school children. The clinic team held a conference on all referrals to decide which members of the team should appropriately deal with the problem. In many cases, all three professional members were involved at one time or another. Only the cases seen by the psychiatrist are mentioned in this study.

The Service community of Singapore Island was widely scattered throughout the Island and Johore Bahru, which is a small satellite town on the other side of the country, and it was in that area that we found the bulk of Naval families. The majority of Service families were on permanently rented accommodation, the remainder being in Service Married Quarters. Again, the bulk of the population lived in bungalows, although some lived in high-rise flats. Our particular area of high-rise flats, caused considerable concern by referral problems among Service Children, attended local infant and primary schools run by the Navy Service. They attended school on the Island on a visitation basis. Secondary education was provided by Raffles and St John Schools which were Junior and Senior Comprehensive Schools and by an RAF Grammar School and Secondary Modern School.

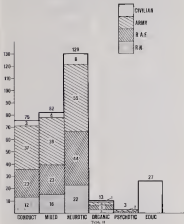
The Clinic accepted a wide range of referrals from various agencies. As in Matthews (1968) study the bulk of the

TABLE I

SCHOOL CHILDREN IN SINGAPORE SEPTEMBER 1969 AND CLINICAL REFERRALS

	INFANTS 1-5		JUNIOR 6-11		SECONDARY 12-18		TOTALS		
	Total No.	Clinical Referral	Total No.	Clinical Referral	Total No.	Clinical Referral	Children	Referral	Referral Rate/1000
R.N.	136	34	835	23	579	7	1550	64	22.1
ARMY	877	48	1005	9	342	21	1624	78	47.5
R.A.F.	1267	27	1717	26	1661	28	4645	81	17.5
CNS	50	7	158	7	144	5	352	39	11.5
TOTAL	2890	116	4805	65	2026	50	9721	261	26.4
Referral Rate/1000	—	34.9	—	13.3	—	27.7	—	26.4	—

DISTRIBUTION OF DISORDERS



admirals from the Navy and the Royal Air Force came from medical sources which concerned with the experience of the Army population where the bulk of the referrals came from the schools. It was found that in the Army and the Royal Air Force there was a close integration between the Family Cases and the Schools, the Clinical Medical Officers acting as School Medical Officers. There was also a difference in the continuity of medical care of the families.

Examination of the Study

During the period under review 307 children were sent from all three Services and admitted to clinics. There were 243 males and 64 females representing a male/female ratio of 3.8 to 1. This compares with the ratio of 1.5 to 1 found by Bennett (1969) and Condon (1970). Of these children, 364 were of school age (Table 1). This represented a referral rate of 26.4 per thousand children at risk. The Naval referral rate was 22.3 per thousand contrasting with the Army rate of 42.8, the Air Force rate of 19.9, and a civilian rate of 3.7 (Table 1). With such a small sample the last figure is suspect.

The study covers a period of some 17 years in which the Clinic was functioning and it shows a correspondence with the rate of 1.5 per cent per annum of school children seen by Bennett (1969). Discrepancy between the referral rates was interesting, particularly in view of the prediction made by Whitmore (1968) of a high Naval referral rate.

The clinical disorders were broken down (Table 2) using a simple classification employed by other authors such as Bennett. This classification comprised conduct disorders, mixed disorders and anxious disorders with additional categories of psychosis or organic. There remained a number of cases which were reported as being

SOURCE:*** CLINIC :
NARVAL :

CONDUCT:*** 21.8% :
21.4% :

MIXED:***** 24% :
20.6% :

NEUROTIC:*** 37.7% :
38.0% :

Total 101

mainly educational. As said elsewhere most of these educational cases had previously been screened off by the educational psychologists. No discrepancy was noted between sub groups regarding their classification, thus a breakdown of the comparison can be seen and comparison between the clinic rates and the specific Naval rates shown in Table 3 (1).

These figures show a finding of mixed and neurotic case material and a relative discrepancy in conduct disorders. It must be emphasized at this point that relatively few real delinquent disorders were seen in the Clinic. They were of the order of 3 per cent of the total. This finding confirms theories of Bennett and other Service authors and contrasts with the suggestions made by Whitmore. As was suggested elsewhere the role of families abroad and in the United Kingdom may differ and wrong-out behaviour may be more solvable in the United Kingdom. The possibility that clinics were not being used so as not to be decorated by the fact that the Child Guidance Clinic abroad is very much on the level line, where there is a total lack of juvenile courts and other coping agencies.

Separation statistics were impossible to retrieve from the medical records in a meaningful way. On perusal of the notes the impression was gained that separation



Figure 4. Range of school mobility of normal Serres children with children meeting range.



was fairly and uniformly dispersed through out the Serres population. It was not a specific Naval phenomenon as we had expected.

Movement (Table 16(a) and (b)) was more easily measured. It showed the school mobility of non-Serres children and the school mobility experienced by normal Serres children in Maine. The school mobility of our clinic sample was shown and superimposed with the normal experience. The Naval distribution was also shown. It would seem that mobility is perhaps less of a potential stress for the Naval child than other Serres children. The question was raised as to why the children attending the Clinic were unable to cope with the life stress. The survey of

intelligence in Table V showed a normal distribution curve with a mean IQ of 88. This was based on 252 persons who were examined for this parameter in our sample. It had been suggested elsewhere that the Naval child was less prone to break down under school mobility stress. With a cross-sectional study of this sort, it was not possible to produce a meaningful correlation. Specific parental mental stress previously treated in Adult Clinic as described by Burtin (1961) was not often seen. However, nervous disturbances, alcoholism and personality disorder was heavily represented in the parents of the children who were seen. Because of our particular set-up, we tended to examine our own clinic and not refer to the Adult Clinic. As a result, an ill label was seldom applied. The level of brain dysfunction shown in the parents did not reach the levels which were described by Burtin (1961b).

Summary

It was suggested that the Naval child was a high risk child in a Child Guidance Service and that a delinquency factor was to be expected. Neither of these expectations were fulfilled in a survey of a Tinian Serres Child Guidance Clinic in Iago-pore. A tendency towards a response of overreaction was found throughout the five-year population possible causes for this type of response have been raised. The

intelligent reaction



critical data for the Naval child was rule. Truly free, the reason for this was unclear. Separation from father did not figure specifically as a stress factor as had been predicted, and the stress was not specific to the Navy School setting as a clear stress sample was no different from one control group of normal Service children, and specifically the Naval child seemed to be less susceptible to this stress. The possibility that the less well-adjusted child would be stressed by this factor was raised. It was further suggested by the author that separation and mobility may only be significant factors when the child is receiving inadequate emotional support at home because of parental personality factor or family emotional disturbance. It was felt that we should not be complacent — awareness of these two stress potentials may well prevent overloading of the already over-stressed family coping mechanism.

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CHILDREN UNDER STRESS

by A. R. Rowatt

One hundred and one years ago Mary Ellen, a little girl, was orphaned from her father and provided refuge from her adoptive parents. Her story came only later as a second group of church workers had passed the Society for the Protection of a Child in America into action on Mary's behalf (Allen & Morton 1967).

First it is necessary to draw attention to some special aspects of the battered baby syndrome underlying the high index of clinical suspicion that we should all possess when confronted with any injured child.

To define the term *Battered Baby* is a term which has both advantages and disadvantages. Its origin dated in a seminar sponsored by the American Academy of Pediatrics in 1961. Knowing that doctors had been complaining — or at least were placing suspicion of how to act — for years about the problem of child abuse it was felt that something had to be done to gain their attention and narrow their focus to do something about the problem (Hill 1976). The term *battered babies* was coined caught on and has proved effective. The term now has come to mean the total spectrum of abuse — that is, beyond the early and mild cases of physical abuse to the point of early recognition of those parents (natural, adoptive and foster) who have the potential to abuse their small children. A good definition is: any child who receives non-accidental physical abuse or abuse as a result of acts or omissions on the part of his parents or guardians.

The battered child is a very special child that is why who is seen differently by

his parents and who has responded in the expected manner — or one who truly is different (mildly, highly intelligent, hyperactive or congenitally defective). Often a perfectly normal child it may be, his parents so he had children called demanding spirit or free. Even a child in this category, with parents who are capable of becoming bad only less than 10 per cent of battering parents are seriously mentally ill all that is needed is a crisis or series of crises to set the abuse into motion — for example a working machine breaking down, loss of mother or father, a wet bed, a husband being charged, financial worries and the like. It is important to realize that some events are as a visual observer would, such as a divorce, breakup, or a family which turns out to be unsatisfactory. To the potential battering parent they are anything but trivial, the diploma awarded even to the movement may represent a precarious balance resulting in a state of anger (Kemp and Heller 1971). It is generally agreed that the stress is on the abuse for abuse, mostly a precipitating factor.

It is also important to note that parents who physically abuse their children come from all walks of life and from all social classes.

How do these parents present? Many clinicians (Kemp & Heller *et al.* (1961) stated that many Physicians had a hard time to believe that such an attack could have occurred and they attempt to abdicate from their medical responsibilities, even in the face of obvious evidence. It is suggested that the following rules of thumb are relevant:

- c. The diagnosis of child abuse must be considered in all cases of traumatic injury to small children even if an apparently satisfactory explanation is given by the parent or guardian.
- d. All children aged two or less (and most older children) in whom the diagnosis of this syndrome is strongly suspected should be admitted to hospital forthwith. Only hospital admission will afford the inter-disciplinary and expert care for an adequate evaluation of the child and his family — and may well avert a child further injury or even death.
- e. The above two criteria are very more important if there is a previous history of traumatic injury explained or unexplained in the child or his siblings and an obvious effect must be made to obtain old case notes, and a copy.

It may be considered that these criteria will render hospitalisation of a large number of children needless; this may be so but recent analysis in the University of Colorado Medical Centre (Kemp and Miller, 1972) showed that 10 per cent of children who were admitted with traumatic injury were proved to have been physically abused. It is probable that a further 10 per cent of the same group of children had also been battered but proved unconvincing. Thus 20 in every 100 children in that particular injury were at risk of further injury or even death and we must all constantly remind ourselves of this fact.

To further develop the point, non-planned trauma may not be the only possibility. Kemp and Miller (1972) have suggested the following points which should make a doctor consider the syndrome.

- If the child

 1. shows evidence of dehydration and/or malnutrition without obvious cause
 2. shows evidence of recent poor care
 3. has been given inappropriate food, drink or drugs
 4. is unusually fearful
 5. shows evidence of repeated injury
 6. is slow to defend, or is fearful by the person
 7. is dressed inappropriately for the degree or type of injury
 8. shows evidence of sexual abuse
 9. shows repeated skin injuries or especially bruise.
 10. shows evidence of repeated bone fracture
 11. shows injuries which are not seen normal in the history

Earlier it was mentioned in the dotted line points who had abused or were capable of abusing the child. How do we recognise these persons? The same authors (Kemp and Miller, 1972) have laid down a series of excellent guidelines which are almost universally useful. One should consider the diagnosis when some of the following are present. If the parent

1. shows evidence of loss of control, or loss of loss of control is admitted to the doctor
2. gives a contradictory or inconsistent family history
3. projects the cause of injury to a sibling, or other third party such as a pet
4. has delayed widely in bringing the child for treatment
5. shows disinclination
6. shows inappropriate comments, or the seriousness of the injury to her own or under reaction)

7. complains about various problems unrelated to the poisoning injury;
8. personally a chronic druggie or alcohol;
9. is defined for unknown reasons by the examining physician;
10. has unrealistic expectations of the child.

Next is interviewing, which, however, is most important.

Child Interviewing

In moments of rage or impulsive action persons may cause mild injuries. These include bruising, particularly of the chest and upper arm, abrasions on the malar eminences of the inner side of the upper and lower lip, and unexplained small lacerations. In some cases violent behavior begins with the onset of small children, who may have no skill (because of age) and awareness of cultural boundaries. These are due to severe shaking or being hit the head.

It is also important to realize that head injuries in small infants may cause periorbital swelling and not overt fractures. The swelling will start rapidly and be collected by four to six weeks after the injury and looks like an internal cast. These findings point to a radiological diagnosis even if the clinical history seems to refute the possibility of trauma (Kemp, 1981; Rao, 1982). It is therefore most important to identify who has been beating, pin or has motion of function or movement but no frank trauma, to report the X-rays six weeks later. It is in these situations that excellent rapport with the parents is mandatory if the child is to be adequately followed and protected. If the child is returned to the home, parent therapy is mandatory. Someone must set up a positive relationship with the person who is here most likely comfortable with that person and be able to control him or her

at any time. There is a direct linkage here with Alcoholics Anonymous. Is the person not only a drinker, but the social worker or health worker was his life saving? Typical explanations which may be given by the treating parent in these circumstances are as follows and should always be borne in mind (Cramer, 1978):

1. he banged his head against the cot,
2. he hit her early,
3. he fell downstairs,
4. he left of the bed,
5. a string hit him in the nursery.

On these occasions the clinical inquiries will often speak for themselves, either by their nature or pattern. Now to consider

Classification

Cramer (1978) suggests the following which is now generally accepted amongst professionals and pathologists.

Type 1 True infantile in which the mother tells the child within a short time of birth many various methods, mostly at hand — such as, beating, cutting, strangling, smothering, drowning or locking.

Type 2 The wasted and neglected child, poorly underweight and ill fed even when adequate food is available, with rashes, sores and other signs, lesions. It is noteworthy that siblings of these children are usually well fed and cared for. Often the mother is quite made aware and the house is in a chaotic condition. Treatment here is to get more support and supervision, rather than punishment.

Type 3 Deliberate cruelty over a period. Beating with a stick or belt, burning with cigarettes, acids or hot oil, bats, urinals, deliberate deprivation of fluids or necessary drugs, such as steroids or insulin — this

lay or layabouts and other forms of deliberate physical mistreatment is necessary that in these cases, police officers should participate and if death occurs the law tends to stand against mistreatment especially when the offender is a male.

Figure 4 The usually battered child which is discussed above. These cases call for more work, the doctor, social worker, health visitor (NHS) and our own Service and its organization.

Having now defined the syndrome and given some guidelines in diagnosis the next consideration is 'what is the treatment?'

If not already involved, the family doctor or Service facilities (where medical officers and Service or civilian health visitor should be involved so that information exclusively in their possession can be available. The paediatrician and radiologist should call in other colleagues such as a neurosurgeon, adult or child psychiatrist, to discuss the findings with the parents who in turn will often admit part or all of the true story especially if they see the paediatrician and paediatrician as people who will help rather than accuse or condemn (Cooper 1976). Obviously the aim tends to split families if it can be avoided. After complete assessment it may be considered safe to return the child to the home under the conditions already stated.

In serious cases (Types 1, 2 and 3 above) criminal proceedings against the parent(s) may be taken. Provided that a conviction is secured, disposal is attended a matter for the court taking upon itself the advice and evidence. Further help may be given by continued health visitor intervention, follow-up visits in poor homes and families often help with poverty relieving or in alleviation of unmet quarters especially alcohol.

prolonged drinking, close liaison between medical officers and the housing officer, occasional officers or community officer day nursery and play group placement, and even temporary placement of the child into care during periods of severe ill health should also be considered that local authorities have powers, laid down under the Children and Young Persons Act 1969 to provide advice, guidance and assistance including material aid to promote the welfare of children and determine the need to remove them into care. This legislation provides an effective safeguard for marginally child neglect, while advice calls for attention to psychological aspects rather than to material needs (Kilham 1976). It has been suggested (Kilham and Walker 1976) that a child protection clinic may be necessary to help parents understand a child's behaviour.

To sum up, the incidence of this syndrome in an infant and young children, nursing (Kilham 1976) is a problem of increasing importance and regardless of the doctors personal reluctance to become involved in these cases, we must all remember that our moral obligation is to the child and we must remain constantly aware that at least 80 per cent of these children are liable to further exposure even death if not recognized and treated. Full investigation including full radiological study, is necessary for the child's protection together with steps to prevent repetition of the ill treatment through Service and NHS medical channels, Service and civilian welfare and social organizations and in extreme cases by legal action.

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SELECTION, DETECTION AND REJECTION The Assessment of Fitness for Stress

by Trevor R. W. Hampton

Introduction

By way of preamble let it be said that my opinions I may regard reflect only my own private views, but I shall take it as axiomatic, that Naval Service involves greater exposure to stress than civilian life and that men selected for a life of sea-based military stress and personal stress and life-threatening stress must form an elite.

It is well known to all of us from personal experience and it is acknowledged by all in the field of occupational medicine that routine physical examination of the accompanying sick is an extremely inefficient and unscientific method of detecting previously undetected disease (Norman 1965). Even so we use this technique in the form of the Pullerina examination in monitoring the health of our personnel from the beginning to the end of their Service careers. It follows that by standardising the Pullerina system and greatly modifying our routine medical examinations we can get a better service to both patients and the Navy, and simultaneously give the doctor a more rewarding and less dreary day task. I propose to consider the scope likely to be relevant to medical selection for entry and readiness in subsequent health screening. Finally I want to discuss such features as our methods of defining and disposing of the medical candidates which we find

a system of codifying medical findings and an selection function and mine are purely administrative. It does not process and was never intended to have any clinical use. Unfortunately it has become administrative not because it does not indicate clearly the type of employment for which the individual is fit, which is what it was intended to do. I shall return to this later but let me first remind you that the RAF quickly found a weakness and therefore introduced their AGE grading. This you will recall gives a numerical code under each of these letters. A indicating what type of duties would be suitable, G what work on the ground, and E in what geographical or climatic areas. In this simple and concise way they indicated for every man what job he might or might not be given.

For every purpose the only part of Pullerina which is relevant is E, since medical history may determine the branches for which the candidate is unfit. Otherwise the fact that he is accepted indicates that F and all the other letters carry 2's. These letters do nothing but divert us from the main task which at this stage is to make a Yes/No decision on fitness for the Service.

An additional handicap at entry medical is the absence of a good medical history. It is true that the candidate completes a brief health questionnaire but in the first fifty percent accounts of these medical histories are inaccurately verbatim (Sheehan-Wood 1971) and in the second half, they are condensed to misquote or omit crucial items of major consequence,

Selection

It is an interesting selection that I want to make casual reference to the Pullerina system because it is at the entry medical that it is first implemented. It is of course

and that the health habits synopsis at present hospitals will always be difficult, only it could easily be obtained by sending a detailed questionnaire to the individual's own doctor requesting a full medical history and offering appropriate payment for this valuable service. Thus, in the same technique as in the clinical form of insurance medical it at once gives the essential form of information for many medical judgments and additionally provides a permanent record ready to hand of the previous health profile.

There is one other starting up in the survey movement. It is highlighted rather than controlled by the M and A issues of the Palladium profile and both of which we have all solemnly agreed to in our time. These two questions of mental ability and emotional stability are notoriously difficult to assess, especially in a psychiatric way in the individual (Baker, 1970). They are in part assessed at entry, not necessarily but in the process of personal selection, but the information does not enter the medical records. It is very important to remember when we are selecting men for a life of stress and especially learning to read that of all recordings at the Royal Naval Hospital Plymouth from 1970 to 1972 inclusive, 21 per cent were on psychiatric grounds. I believe that there is scope here for much greater cooperation between the medical and psychiatric branches in assessment. It is very important not only that this aspect of health should enter medical selection documents but also that the relevant facts should enter the medical documents. The present Palladium forms are not only irrelevant here they are positively misleading.

Lastly, primary medicals are described as being brief (M issues) they are not. Medical discharge from our entry establishments can and does mean at any time that the man proves to be unfit for the Service although sometimes the matter

may, of course, and inevitably, need to be resolved (M issues) a man's fitness for a life of stress only becomes apparent when he has been exposed to it. It follows that the appropriate timing of final assessment is also the last few weeks of training.

Discussion

Moving to subsequent health monitoring the present arrangement is for four yearly medical examination and we have the same problem as before. The physical examination of the unaccomplished adult is an extremely inefficient way of detecting previously undetected disease and this is especially so in the 20 to 25 age group. The only findings which appear with significant regularity are obesity, hypertension and glycosuria (Baker, 1971a) all things which we can measure objectively and yet we keep no records of weight, blood pressure or urinalysis except for officers. I suggest therefore that in this age group instead of putting detailed 1% on all the Palladium forms we simply record height, weight, blood pressure and urinalysis. We should then at least be adding some relevant facts to the continuing health profile of the individual.

The only other value of this brief and limited health review is that it provides an opportunity for trying to fill the concept of positive health and the advantages of physical fitness. The subject of fitness is mostly of a popular paper but in the context of serious medicine, one must remark that most doctors regard themselves negatively as discoverers of disease, rather than positively as promoters of health. The difference in philosophy is important. Tests of physical fitness do not form part of routine medical examinations except by a few rational and enlightened doctors. A simple test of present tolerance would be of more value than most of the present Palladium examinations but it would have to be associated with a programme for

improving physical fitness when it was found deficient and most of us, and I include myself, are not playing our proper part in promoting the health of the fleet in this way. Although I know there are one or two outstanding exceptions in the gentleman.

In the late 50s or early 60s, however, health problems began to appear with more significant incidence, and the possibilities of early detection and prevention became more important, so that we need a means of giving a better service in the late 60s in terms of advice on the preservation of their health. It is not only important to the individual it is important to the Service, since this age group comprises rather more NCOs or more commonly senior officers at positions of responsibility and considerable stress. I therefore want to ask whether we can usefully make our screening procedures more sophisticated for this age group.

The increasing incidence of coronary thrombosis has made this one of the lead age fields in which a predictive indicator has been sought in the hope of obtaining properly active measures (Turner and Bell, 1970). Unfortunately the idea that the electrocardiogram might indicate either past heart disease before the onset of symptoms is rarely fulfilled, and examinations do not greatly improve its diagnostic value (Circulation, 1971). Short cuffs has shown that even at the onset of a myocardial infarct the ECG may be negative in up to 75 per cent of patients and negative or of no further 50 per cent. The work of Rowe (1970) and of Chazotte (1974) revealed that minor ECG changes may be found in 5-10 per cent of asymptomatic middle aged men and of these 70 per cent will have a major ischaemic episode in the next 10 years but at many the changes are temporary. If serial records are made over a period of years, the prognostic value is increased especially

if the test first is when a patient with Myocardial Infarction (M.I.) has been discharged. I think there would be a case for an ECG as part of the medical screening of the over 40s, but interpretation would require great caution and the yield would be low.

There are other factors which give good indications of coronary risk (Durrant and Bell, 1973). For instance, the risk of dying of coronary thrombosis below 50 is doubled by a smoking duration pressure of over 150 mg or by smoking more than 20 cigarettes a day and there are factors which we can treat or about which we can give helpful advice. The risk is also doubled by a fasting blood cholesterol of over 300 mg per cent which brings us to the question of plasma lipid estimations.

There has been considerable work on the predictive value of plasma lipids in ischaemic heart disease. Both cholesterol and triglyceride are good indicators of risk, but total lipid levels are better still (Mittleman and Benfante, 1972). Box of all six serial lipid measurements, and in the prospective study by Grosser and his colleagues (1968) all subjects who suffered coronary thrombosis had shown a marked rise of at least 50 per cent in plasma lipids in the 12 months preceding the event.

This question is also important because we know some of the factors associated with high plasma lipids such as obesity, inappropriate diet and some forms of stress (Taggart and Campbell, 1971) so we are able to give advice and if necessary specify treatment to reduce these levels. The problem is that plasma lipid measurement is a tedious and expensive procedure and we have to decide whether we consider the expenditure justified. My own view is that if we intend to use any special techniques to predict and reduce coronary risk, this is the first principle case for treatment. The best prediction however depends upon a knowledge of all the risk factors I have mentioned.

The value of blood biochemistry in screening is disputed and for the sake of brevity I do not propose to discuss it further. The same applies to the use of liver function tests, with the possible exception of enzyme levels, especially gamma-glutamyl transaminase in the detection of cirrhosis, and the latter consideration might justify their use in view of the importance of this diagnosis in the group under consideration.

I shall say nothing about genetics, about X-rays except that in one statement I believe them vital to the use of the most valuable of screening procedures, and I believe too that there will soon be cause to argue that the programme of mass radiography of the civilian population has been so drastically reduced.

Finally, a less importantly borne issue, that in any form of health screening the yield of positive results is very low when the subjects are asymptomatic. It follows that any technique which relies, from the patient's own personal account of his work performance and of any disabilities he may have noticed, will allow cardiologists to be alerted to appropriate diagnosis with the prospect of more useful results. I know of only one place in Europe where this difficulty has been overcome efficiently and systematically and that is in the London Medical Centre. There a self-administered health questionnaire is completed and passed out by computer and is available to the doctor at the beginning of the consultation. Very particular tests depend on that used at the interview to elicit relevant family and work histories, habits and attitudes, and serve as indices to all of these. In this way a quite unique source has been found of making the history an appropriate starting point in the examination of an screening among rats, but just as it is in the normal clinical situation (Penney, 1977). I think that these techniques have a great deal to teach us

Of course the work of such centres depends upon a great deal of highly sophisticated equipment representing enormous capital investment provided only by hell and it is therefore questionable whether the Services should set up their own independent organisations when the last ones are already available.

In the end much of what is decided will depend upon what sort of time and money is considered possible for the purpose and this is one reason for arguing that the most realistic screening should be restricted to the most vulnerable age groups, but we must transform the common sense a certain medical and a useful dialogue between patient and doctor in which work can be taken of the current situation, problems areas defined, appropriate work and his history identified, and what advice given. This makes the situation a consultation and in such cases recording for both patient and doctor. Once again the Partnership has nothing to contribute.

Prognosis

Finally, how should we deal with the medical dropout? This is not the place for discussion of which conditions should lead to smoking and which not, except to say that for the young and recently entered, smoking thresholds should be low so to re-statement the time wasted by them in the Service and by the Service on them. Conversely the threshold should be high for the older, trained, valuable man. The problem is and always has been that of the twilight zone between fitness and infirmity, and if proposals for earlier diagnosis are successful the twilight zone will get larger. We already have this problem, for example in the mild hypertension. We now believe that a rising diastolic pressure in a young man of 140 mm or above should be low-red even in the absence of any other manifestations of hypertensive disease, and we now have drugs which can achieve this

VIETNAM AND AFTER

by Rear Admiral Charles Wente, MC, USN

Medical Support

Early in the Vietnam conflict, the US Navy was primarily engaged in the coastal defense and an adjunct to South Vietnamese and the Navy Medical Department was primarily involved in providing field care to the Marines actively engaged in combat. To this end the organic medical support was an area supported by a 300 bed H hospital, three naval hospitals in DaNang and two off shore hospital ships. The hospital ships, *Repose* and *Sansoneer*, each with 140 beds were used as mobile floating care facilities and not to transport patients from one shore hospital to another. Their employment in South Vietnam was vital because in the areas covered up and down the country the ships could be guaranteed either as advance or as needed to cover the medical requirements. As you know, neither ship was originally designed for carrying more than 100 patients in World War II and they were not really designed for that long continued medical care in some instances. But with considerable medical workloads and the capability for total disaster care was achieved and a helicopter platform steadily provided the method for medical evacuation procedures. The US Navy does not now possess a ship designed from the keel upwards to fulfil this role but we are seeking one. The hospital ships had several shortcomings even with the integrated business. They had no dedicated medical communications systems when they first started and had no organic helicopter support. One may not do not believe in dedicated medical helicopters for use like this—they will

share them very generously they will take on a load of casualties and bring out a load of patients but that is the system in which they will go. One of the strong recommendations that came out of Vietnam was that we should have dedicated medical helicopters. However, there are times when you want your helicopters either for resupply and low visibility occasionally caused problems because the small craft and helicopters were unable to transit and land the hospital ships and this was particularly the case with helicopters landing on small platforms. It was just a year ago that we lost one of our *Admirals*, during a helicopter landing at night in the Pacific. One of the blades hit the superstructure of the ship and the helicopter flipped over and landed upside down in the water in total darkness, and we lost the Admiral and some of his staff.

Business

Adverse with the warner early in the conflict we had one major problem with dysentery, malaria and hepatitis. It takes an amount of experience with possible epidemics of gastrointestinal because frequently in a build up situation such as we had in the early Sixties the casualties, business, mass bulk, etc., do not match the speed of troops. This leads to certain overhead and breakdown. Additionally, in the roles of peacetime, combat operations and the daily business of just staying alive sometimes causes things like mosquito discipline to be expected much things in clothing, eating, repellent and medical drugs until the non-combat zone almost exceed the combat situation and

then you just get the General's attention and make some progress on preventive medicine! This led early in the conflict to a renewed interest in preventive care throughout the fleet and resulted in the following signal from US NAV ACT Surge:

A grateful parent, after having been told that the stomach has died and a lot more should be in patients. What's the proper recommended disposition of remains? Back came the signal from BUMED which read: Recommended that you in a hot area as MS. If for two days served with a mile order of salt and what come then appear! That is a true story.

The domain of military importance in Vietnam were those you would suspect malaria distribution: the so-called rivers of unknown origin and low areas. There were more rain days but due to domain than to occupy by a ratio of 2:1. This was significantly lower than one World War II and Korea experience which was 5:1 and sometimes higher. In our peak year of 1969 there were 4,000 cases of malaria in a Navy Marine Corps population of 100,000 or roughly a case rate of 4:1 per year.

Malware

The troops with malaria occurring in the Continental United States from the combat zone had 80 per cent were malaria and 20 per cent filiparvum malaria. Our approach to malaria prevention and treatment in Vietnam consisted of so-called malaria or mosquito discipline: (a) protective clothing, (b) insect repellent, (c) netting, (d) area spraying by air and (e) the use of chloroquine proguanil (C/P) as a suppressant.

The biggest waste of money and time in the entire war was the aerial spraying to reduce mosquito populations. It was never delivered in the right place at the

right time or in sufficient quantity to be effective. The nature of the warfare (a) and (b) and (c) deterred from and the hazards associated with spraying the spray was hostile territory was continuing losses in the overall battle.

Malaria discipline with the doctrine of self-directed therapy became a casualty in the high level and humdrum Mosquito killing during a surprise attack was something the forward troops quickly discarded.

Chloroquine-proguanil was very effective against malar, but in the latter part of the war the filiparvum broke through and was 70 per cent (which fell on C/P) and gradually approached 80 per cent and higher at the war's end. The individual repellent was moderately effective when used, but much of its effect was diluted by the varying interest by the climate.

One interesting side note is the fact that the Viet Cong and North Vietnamese had as much difficulty with malaria as we did. That may seem surprising for an indigenous population but I know specifically that one group of mountain tribesmen who acted as scouts and went off with the mission for longer into the bush, came down with malaria as soon as they left their single mountain and went on an independent way from their own area. This was reinforced by the fact that one malaria case was directly related to the interest of control our troops had, particularly with the regular VC.

One final comment on malaria. During the entire conflict we were never able to specifically pin down the response of the principal human vectors of malaria from the more all reactions of mosquito/poison present in Vietnam (a) type of vegetation field in search effect although we did know that anophelis tritaenior and anophelis species were important vectors. The lesson here again is that the combat zone ranged far and wide and the risk of collection was great. The need for more research in

certainly before combat and not during combat if you can make such an arrangement!

The future for malaria control and treatment is still not bright. We are certainly losing a wide range of new resources now which is impregnated with disinfectant-made and which gives off a cloud of insecticide which hits a few insects and which seems to be accepted by the soldier and nurse. Meanwhile, research continues for better repellents and, hopefully, a vaccine.

Water borne diseases

Water was the single agent causing more medical incapacitation in the US troops in South East Asia. This was caused by an effectively treated water carrying disease.

Shigellosis, along with dysentery and viral infections, were the three most military significant diseases because they could not be treated without causing either a massive antibiotic epidemic, which could trigger a local resistance to combat. In April 1968 in the Achar Valley, one field unit had 1000 cases of Shigella shigellosis. It was almost water borne and it was treated by a temporary power plant supplying the shigellosis. The area running it just beyond the observation and we had 7000 cases.

For the future, because we using liquid treatment as a main antibiotic is driven right on moving parts and delivering a low concentration of 20 mg per cent, leads great pressure for field use and, hopefully, will lower the risk of shigellosis and other water borne diseases.

Our large group of diseases, partially distributed levels of treatment regimens were served only to maintain an epidemic. These so-called (LLO-) were one third acute typhus, one third dysentery and other enter fevers and one third not identified.

Immense loss, in spite of the losses in South East Asia, were not a major pro-

blem, because the water temperature was warm.

Relax

Relax was not significant despite the fact that one fourth of the susceptible animal population was no doubt infected. There were only two documented relax deaths in the full troops area through every platform had its own impact. The symptoms were, that in addition to being very lucky, relax is not a very easy disease to catch. To quote the known experience where groups of mild relax have taken on a whole human area, only one in ten of human humans will come down with relax. Also the virus did a good job in measuring the pain and death, which was extremely efficient when used promptly.

General observations concerning measles and measles virus in combat

There were, approximately 100,000 measles in Vietnam and 40,000 killed. That was a measles/killed rate of 5:1, as compared with a 3:1 ratio which was a markedly constant with World War I, II and Korea. Many of us feel that the difference for the better is largely due to the helicopter evacuation of casualties. In future situations if we do not have control of the air, helicopters may not be possible. Even if we do have control of the air, helicopters can still be extremely vulnerable because of such things as land field accidents and lost landing accidents where a star can be totally wiped out a half circle.

It is also our considered opinion that the use of continuous positive pressure ventilation (C-PPV) to improve the PO₂, combining the two long post-operative respiratory distress syndrome and the central stenosis to fluid and blood replacement, with other major contributing factors, is warranted. Our plan to use blood

found at Vietnam quickly substituted for some of the 4-5 hours, during time required. Our two hospital ships when they went to sea made up the Vietnam conflict had a device called a Spheroconizer which is a specific device to concentrate breast blood. When the surgeon wants blood he wants it quickly and cannot stand around for four to five hours waiting for it. In the breast blood was quickly replaced by fresh blood from the large reservoir in the States which was flown in 82 Airdoc and mostly administered within 2-4 days of being drawn. This blood programme was one of the in-service programmes administered by our post, contained in CINCPAC and implemented by a central regulating office in South Vietnam. We regularly controlled the flow of patients to hospitals in-country, offshore supporting hospitals and patient evacuation back to the continental United States. When I first reported on this job we were regulating over 1000 patients a day. Our Pacific Area Medical Regulating Office was at Camp Zama, Japan and in addition we had a regional regulating office at Military Advisory Command Vietnam at Saigon. Early on the conflict we did not have this regional patient regulating and patients were flown to a hospital which was full while another hospital would be empty or a patient with a head injury would be flown to a hospital which did not have a neurosurgeon while at another hospital two neurosurgeons would be keeping around with nothing to do. This was quickly solved with the establishment of a well coordinated regional regulating office.

Concerning blood the most desirable blood for transfusion is fresh type specific. However the urgent nature of many of the serious wounds resulted in the use of much O+ blood. Our experience showed us that such a patient recovering up to three units of O+ could easily be converted to type specific. More than that made a de-

cidable in contrast with O+. Our experience also showed us that such a patient usually re-established his own type specific blood after four days. Also in the serious transfusion situation it was highly desirable that the last two or three units given be freshly drawn from young troops, non-combat troops etc. to prevent bleeding and clotting disorders.

Throughout most of the war we had a surgical research team at Naval Support Activity, Da Nang. The following is a brief summary of some of the data and recommendations gleaned from their very detailed and interesting reports:

The wounding agent accounting for the most casualties was artillery and its subsequent associated multiple fragments wounded almost was gunshot and third degree and lacerate troops. It was also interesting to compare wounding agents with combat experience. They have a graph that shows that the men with little experience were made more prone to arm and lower extremity wounding than the older men who had had more combat. It also showed that as a man's time in combat increased he was less subject to all types of wounding and from looking at the statistics it is significantly probable that the less experienced had a lot to do with the propensity for not being wounded.

The peak of casualties was reached in 1968 when Navy and Marine Corps personnel sustained over 11,000 wounded, 60 per cent of whom required hospital care. Of that 60 per cent, 18 per cent were admitted to duty via medical hospital, 7 per cent were immediately ordered other treatment, 2 per cent required prolonged treatment and 19 per cent were treated actually in Viet Nam and returned to combat. The mortality rate for this group was 0.84 per cent.

Head and neck wounds had the highest mortality, such constituting over 24 per cent for a combined total of over 40 per cent. Abdominal and thoracic wounds were

and each contributing approximately 10 per cent. When the head and chest or abdomen were both wounded, the mortality was the highest being over 40 per cent. Fully aware it might be concluded, was more obvious that the bullet and indeed this may be the case. However in Vietnam the bullet was not always work, because of the heat and nature of the country. Roppy camouflage both have been worn which afforded no protection at all except from the sun.

Penetrating neck wounds came with very obvious, superficial appearing entry wounds were extremely deep and it was concluded by our senior surgeons after the war that to treat such patients generally should be explored without fail. Anything penetrating the front of the skin would be worth stopping because of such things as ends of the external carotid artery but more important, popular vein laceration. This particular type of wound contributed to the higher mortality from the neck than anything else.

Compared with the Korean experience with penetrating abdominal wounds and it is not only mortality there was little improvement during the Vietnam War with 50-60 per cent. This clearly is an area we need to look at in depth. Thomas wounds on the other hand were consistently improved in survival rate and I think this was due to the fact that we had people very skilful in maintaining airways, and delivering partial pressure oxygen.

Infection in a post-operative chest for death was more significant than death. Well over half the deaths of patients surviving long days, or more were due to infection. This represents another valid area for research research.

The art of longer came in a very high rate during Vietnam but it was not when we first started. A delusion of troops required is that you have the severely wounded patients and only four operating

rooms - that is when you have a large number. The wrong lack of troops in the field was something that most of the surgeons complained about and they commented that patients with minor wounds were being evacuated to hospital with about the same frequency and time interval as the severely wounded.

The arrival and off was witnesses however, show that for every 100 wounded, 40 patients were treated by nurses or forward medics and was evacuated to the hospital. It sounds like the worst and story with the operations in the hospital wing. Then 40 must not even get the patients he sent to me. Although there were forced to be sent about.

A quick summary of our combat experience would be that there really and the history with special attention to the way the fluids and post-operative infection.

Throughout the conflict we had Navy doctors and companies well out in the field as advisors to the provincial medical facilities. Despite the contrary evidence, few of our people were harassed or attacked, clearly because it was impossible for them to be in the enemy (VC) from the blockade and all revealed the limits of our combat zone.

In the latter part of the war, our bulk capture prizes in their defections, commentators would be detractors that the enemy was not continuously living in our rear and our bulk captures despite the very small and close on an otherwise all their uncollateralized knowledge.

With considerable advanced pathology General Heston the M4Y supports in a he knows that all seriously damaged choppers would be all when with large and serious and when the programme went into effect, it was completely successful. Again I might add that wounded VC were frequently brought out with our own wounded.

The latter part of the war was that the

scribed as an exercise in the art of draw-down. Making a gradual rediscovery of all medical support by the Republic of Vietnam. Thus they did with amazing success. The essential part of the operation from the US medical viewpoint was the adequate medical support to remaining elements and the 3d Fleet operations which were ground troops were leaving to sea members, sea level operations reached an all time peak. This was at a time when we were withdrawing the troops and it was decided to name House Harbor throughout the bridges and cut off the loggers. Then the Navy's troops went up and we had days that were hot and days that had what we call a 'start-off' when a shell got off in the beach causing death and wounds. During this period of off-shore bombardment, strong and heavy air strikes, an achieved success in this setting by using aerial support teams partnered with the operating fleet. Most of these teams were on loan for a period of 60 to 90 days from our major teaching hospitals and they were flown to the Gulf of Tonkin. They were a team used to working together. There was a mix, gun, an orthopaedic surgeon and some anaesthetist, several operating room technicians, and male nurses. Most of all there was an air support helicopter team as well as an air and did not have to be recruited. The few remaining additional long term care were helicopterized to there and flown by C-124 hospital plane. An air force dedicated hospital plane with a range of about 1000 miles. They will take the walking wounded 24 hour care and have a nurse station back on, with an anaesthetist care team in the rear of the plane. It has a speed of about 300 knots, it does not fly across the Pacific because of the range but it is very useful in the interior and they are being used to a great extent in the United States. They were flown in the 3d hospital plane to Clark Airforce Base in Yakusaka.

The problem of drugs in South East Asia

was a few weeks made for the US military but with the draw-down and end of the war a decision was made and here a problem. It was partially a failure of leadership and mobile management (Divisional Officers and Senior Policy Office level), but it also came because of the setting, namely a very unpopular war in a very unpopular place. We had a bunch of doctors it was not an all volunteer force and there were major contributing factors. We suspect that some of them came to Vietnam to get their service because it was a lot cheaper than that in the United States. My advice would be — stay away from unpopular conflicts, maintain an all volunteer force, stay away from areas where drugs are cheap and our family support your junior officers and policy officers to be responsible for the welfare of their charges. Anyway as my UK friends having to prove me right we believe that kind of security and leadership, we really can't hope to solve the problem at all!

There were less psychiatric patients during the Vietnam War than in the World War and Korea in spite of the fact that it was an unpopular situation. Only 15 per cent of the patients with serious and psychiatric (paranoid) together) required long term care. The typical susceptible was a junior or policy officer, a combat officer, a shoulder injury, responsibility for periods of more than six months in active combat and put in the zone. Similarly most had a strong sense of responsibility and personal identification with their unit and an excellent record under fire. Fortunately many of these cases of stress or emotional anxiety (anxiety) began to return to duty after 14 days of rest and change.

Phobias of War

The second (1 st and 2 nd) study in 1972 was for me personally the most rewarding of my experiences in the First Command Surgeon. In early 1972 I was directed to

real, all possible ideas for our POW's to learn and develop a system for their problems and into organizations with special emphasis on a thorough medical workshop and rehabilitation. This project naturally had major political significance at the time and more of an left than the US News Media was just willing to make acknowledgment of and the entire operation did not go off smoothly.

There were numerous conferences and seminars and many with the low POW's, the North Vietnamese and Viet Cong had presented as a token during the war as well as World War II and Korean as POW's. There was much discussion concerning the speed of return, whether it was harmful to get them back to the States too quickly also what kind of food they could best tolerate and numerous critical points on their medical condition.

Well, we were more often wrong in our opinion than right, but the thing that saved the whole program was that we had designed a flexible system and the medical personnel running it were intelligent, flexible and humane. All other things being equal, South and the Philippines were given more consideration for the first phase of repatriation and eventually Clark AFB and its hospital commanded by Colonel Gled received the nod because of the shorter flying time from Manila to Clark AFB, a little under two hours.

Between February 10, 1971 and March 29, 1971 364 Navy and Marine Corps POW's were returned to US control. After a thorough medical working in Clark this point, the operations were transferred to military medical facilities nearer their homes and back was accepted a military escort (age, service and specialty) to Clark who stayed with them until they were well on their way to recovery or ready for return to duty. During this period I personally went to Clark and my assistant Captain Don Good remained there to co-

ordinate naval medical activities for the entire period. Additionally we had six civilian medical residents from the civilian medical programs at Pensacola and they took turns flying into Manila and back with the rotations and then on back to the States as they were finished their civilian medical education. This proved to be a big decision since we were losing big money figures and the naval flight surgeons were worth their weight in gold.

Detailed medical evaluations were continued at 15 military Naval Hospitals. As of November 1, 1975 125 returned Navy and Marine Corps POW's had appeared before medical boards. Of this number, 114 have been returned to full duty, four to limited duty and three were medically retired. There has been one tragic death, a suicide by a psychiatric Marine POW. Thirty-one prisoners are still undergoing medical care and treatment.

The most common diagnosis established for 3,446 returned prisoners of war were in order of prominence:

- Trauma
- Anorexia
- Dental stress and periodontal problems
- Amnesia
- Diabetes
- Heartburns
- Nervousness/depression
- Peripheral neuropathy
- Prominent and deepening wounds and scars
- Thyroid and lumber vertebral disorders

The frequency of the deepening ranged from 42 per cent for the lumbar/lumbar to 8 per cent for the lumbar cervical disorders. The ulceration and excisions were not surprising, neither was the dental stress and periodontal problems. One thing we might add to our Search (Eviction, Rescue and Escape training (SERE) training) is a lot of these men got a bag or piece of wood and work it in between the teeth to massage

the game, and this might help in the future with the psychological problems. Some of the deaths, and further ventricular fibrillations were of course due to exposure injuries. Long term and short term natural medical follow-ups are of course planned.

My own personal observations of our navy returnees, most of whom were carrier pilots, and their overall conductive personality. Their mental attitude was much better than anything we had anticipated. There was a significant history of loss for worry and melancholia in general during the long years of confinement, many were there seven or eight years, which was not seen on appearance. This was because during the POW experience which went on for over a year prior to their release, the North Vietnamese and the Viet Cong made a concerted effort to improve the well being of their capturable product. Some of our people died during imprisonment — many as death through gastrointestinal. The severity of and spread was kept close with the maximum of technique and medicine. In general North Vietnamese POW's were in better condition than the Viet Cong POW's principally in the malnutrition and exposure areas. This was because the prisoners of the Viet Cong were literally kept out of doors for three to five years and had to a way of night and as the temperature moved about the countryside they dragged their prisoners along with them. If they couldn't keep up then they were put to bed.

The same was present that a few of our people lost the will to survive and turned their back to the wall and died.

There is no doubt in my mind that the reason why most of our people survived and did so well was that a good camp discipline was established very systematically and very rigorously and this contributed greatly to survival. These people were not in a Sledge, such as they were in in World War II, when they were regularly courted

and had a mess hall where they could get together. They were kept in isolation, pens in only the same people because then you can break down immediately psychologically if you can get to the mess eat at a time. However, the RCAF (using makeshift tables) asked by your own for Robert Thompson of Malaya was highly effective and had a major impact on survival. The carrier camp commander in each area was well disciplined and his subordinates did and they managed to communicate by tapping on the walls or by leaving messages in a key place — perhaps paper was rolled in a rat shell or wrapped in the back of a rug.

There were men who ate what we call walking memory books and each one of them when they first got back to Clark before they saw the doctor, wanted to be fed and for six hours most of them, might subvocalize, give names, make words, were very close to subvocalize to camp, almost to death of the mind, and here they had access of the goods, weather conditions, the food — and it was just like running on a tape and bring them all go. They had carried this information around with them some of them for five, six or seven years.

There are still 1120 missing in action who are still unaccounted for and we have a Joint County Resolution Centre and they will keep searching for another five or ten months, but the evidence seems to be that now we have not found right now we are not going to find or get any sort of report on.

And finally, don't let anybody tell you that emotionally deprived men need a close probably paid return to a normal high culture and because it just isn't true. A good way to contact people would have been to place yourself between the returning POW's and the shore line. They are everything.

Conclusions

I would like to conclude my talk this

afternoon with a brief look at our future problems and how we are hopefully planning to solve them. We are now in the post-war era with the expected. We have no Red Cloud here, animals very much as before.

We are living with the all-solutionistic health concept which includes the end of the doctor draft. Personally I think such a situation is more healthy than the present one we have just come through. However, we will be faced with lower budgets and less people. The main problem is now compounded by a general trend to curtail health care delivery and we must compete for scarce resources. The key to this problem lies in job satisfaction and competitive salaries. Simultaneously there are government forces (tax and medical) which seek to consolidate all federal health care work under one management. The US Navy Surgeon General, Dr Cline and I feel that the key to survival here is the unique operational medical requirements of the Navy and we intend to exploit this to the full.

Another healthy adjustment we must make is to quantify the maximum utilization of our manpower in operational support and patient care. This we hope to achieve through an extensive reorganization positioning of our resources in close alignment with where the Navy is in strength and maximum use of physician substitutes with

adequate support when the system can be accommodated with this level of staff.

A relatively stable peace time situation is a good time to address improved diagnostic technology, maintenance, preventive medicine and education, and this we intend to do.

Everyone has some pet project or dream and I have mine. It is in a general sense an attempt to the maximum extent of the available accomplishments of this century to cut our costs. Specifically, the improved use of patient care in remote locations. More specifically I am interested in a remote medical diagnosis system now under development. The use of hard satellites for medical assistance, new concepts in patient transfer at sea, including helicopters VTOL aircraft and surface attack craft and the telemonitoring of vital physiological data from small ships to large ships.

Related subjects include a general review and significant spreading of training of our independent duty computer (physician substitutes) and developing continuous of school training for those which will expand their knowledge, skill and usefulness. This includes some purchased courses contrast to sea while they are at sea and a relevant clinical programme when they are ashore. On the fringe is an idea for a computer programmed diagnostic logic and emergency treatment system as an aid to the isolated medic.

[illegible]

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197) from the British Museum a New York and is a new but published word in *Parasitica* bibliography. The fauna of the parasites which parasitizes are known but has remained in a state of obscurity. These fly now study new infections and 11 species and their biology remain still responsible for the increasing level and the diseases. The observations in the development of the parasites and the way they spread are there actually through the host and the fly. For example, the way the parasites spread in the hosts. The approach of such studies in parasitology is more than just medical importance and comparative. The more likely likely that the host and the host diseases of *Colletes* (parasitism) in the first stream study infections in laboratory. The study of insects and fly have spread the study of insects and fly before described — from the insects of the fly.

It also expects less help added by the office buildings and manufacturing sectors. It will also bring in 1,000 new workers, including 500 from the private sector. The total jobs added by the state will be 1,000, the same as last year.

Postmaster: The Editor, <i>Journal of Management Education</i> , 1015 Locust St., Suite 100, Philadelphia, PA 19107

This manuscript (abstract) was prepared in haste for delivery at the following: a) all of based on the well known language in natural sciences. No supplementary literature is mentioned with the appearance, some in which are displayed on the cover. It is a detailed attempt at the, most as a sketch, but not be suitable for the display of the text at the time preceding the day - the author and reader of the book, not possibly, to have completed a manuscript against a brief, second or third round discussion. The con-

shores of the head, lateral through very short. ...
It is
... ..

PLANNING AN INDEPENDENT CHURCH. By JOHN F. HARRIS. Revised edition. Pp. 126. London: Mayhew Press. 1980. Priced £2.95.

This book presents a comprehensive discussion on the planning of all municipal facilities, including housing, education, fire protection, law enforcement, health, recreation, and cultural centers.

[illegible]

Reprinted by permission from *Chemical Aspects of*
Antismoking, by T. P. Pech and M. J. Allen,
 pp. 19-20. London: Lloyd-Luke Medical
 Books, 1988.

The authors' research found various hypotheses. First, as expected, we did not find a significant relationship between the use of the Internet and the use of the Internet for information seeking. This is not surprising, as the Internet is a widely used tool for information seeking. Second, we found a significant relationship between the use of the Internet and the use of the Internet for information seeking. This is not surprising, as the Internet is a widely used tool for information seeking. Third, we found a significant relationship between the use of the Internet and the use of the Internet for information seeking. This is not surprising, as the Internet is a widely used tool for information seeking.

in the 1980s, but in 1990, the number of people in the United States who were employed in the service sector was 100 million, or 60 percent of the total workforce. The service sector is now the largest sector in the economy, and it is expected to continue to grow in the future.

These procedures are closely related, very analogous, and are interconnected. However, while some of the data used by researchers are shared, like in the case of procedures, not the values of procedures.

relativistic specification and in the consequent position on measurement of the system's length it is disappointing that the value of γ appears in the part of the chapter which is about table 10, 11 and 12. It is clear that mistakes have been avoided in the final chapter.

Although this is an excellent little book and the layout and typography helps towards this aim, it must I should be, very well equipped for use as a textbook. It may be thoroughly recommended to a first year, first class student. F.C.F.

Elementary Mathematics in Mechanics, by E. H. Rees, by Sir A. S. Taylor, Pp. 232. London and Edinburgh: Churchill Livingstone Ltd. 17. 6s.

Volume 2 of this excellent series, published only last year after its predecessor, really does seem to deserve something like a review. There are 17 chapters in 265-odd page volume. The subject is fairly wide in fact, but in reality made to include topics of as wide an interest as possible, as well as to bring in a more general outline, attention is paid to all the major subjects of physics.

The standard of presentation and writing is very high and there are excellent lists of other topics which will help.

Some of the chapters should be treated and so far all members of the Royal Naval School of Science, Portsmouth, a collection of The Library of Civil Science, from Newton to find a very pleasant paper on fluid flow, a chapter on relativity and a fascinating paper on the cosmology of the universe. The book is written by Sir A. S. Taylor, Pp. 232. London and Edinburgh: Churchill Livingstone Ltd. 17. 6s. The book is written by Sir A. S. Taylor, Pp. 232. London and Edinburgh: Churchill Livingstone Ltd. 17. 6s. The book is written by Sir A. S. Taylor, Pp. 232. London and Edinburgh: Churchill Livingstone Ltd. 17. 6s.

A further advantage of books of this sort is that they are cheap and can be used in a wide range of circumstances. The book is written by Sir A. S. Taylor, Pp. 232. London and Edinburgh: Churchill Livingstone Ltd. 17. 6s.

The Editors and Publishers of this valuable volume are Sir A. S. Taylor, Pp. 232. London and Edinburgh: Churchill Livingstone Ltd. 17. 6s.

An Introduction to Mechanics, by Sir A. S. Taylor, Pp. 232. London and Edinburgh: Churchill Livingstone Ltd. 17. 6s.

The present book is a general physics text, written by Sir A. S. Taylor, Pp. 232. London and Edinburgh: Churchill Livingstone Ltd. 17. 6s. The book is written by Sir A. S. Taylor, Pp. 232. London and Edinburgh: Churchill Livingstone Ltd. 17. 6s. The book is written by Sir A. S. Taylor, Pp. 232. London and Edinburgh: Churchill Livingstone Ltd. 17. 6s.

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[illegible][illegible]

Any short-term thinking about how the labor market should be run is I would suggest, silly and harmful if it leads people to believe markets are more efficient than they are. — J. B. IVES

Tanner's Choice: Frank Michael Jernsdal Felt
 (1928-2006) *Vol. 1, No. 10, p. 38*

[illegible]

Any collection of a series of numbers and associated units is referred to as data, and the values in an experiment, they might be used to construct a model and will require but an attempt to read the book, even used to derive will surely much less valuable than using the separate chapters on experimental

There have been differences in the results concerning the effect of the type of the stimulus on the response. For example, the results of the present study are in line with the results of the study by Kuhl (1991) who found that the type of the stimulus (word or nonword) had no effect on the response. However, the results of the study by Kuhl (1991) are in contrast with the results of the study by Kuhl (1991) who found that the type of the stimulus (word or nonword) had a significant effect on the response.

Thomas A. Jones, Jr. of Commercial, Insurance
 United Sav. & Loan Bldg. 10th Floor, N.

The little finches in this study performed well despite some characteristics such as a lack of beaks that suit very specific diets. Despite their long-term loss of an avian diet feature, they cope with the diets that nature offers, including predominantly plant-based diets. It is not just the development of well-developed planters from the first year of which these birds' long-term survival depends that are, which means the study is by nature, not just the birds and others of feeding. This, as opposed to the high cost of feeding, is a key factor.

the 1990s, the U.S. economy has been able to maintain a high rate of growth, despite the fact that the economy has been hit by a number of major shocks. These shocks include the Gulf War, the Asian financial crisis, and the Russian financial crisis. The U.S. economy has been able to maintain a high rate of growth, despite these shocks, because of a number of factors. First, the U.S. economy has a strong and diversified industrial base. Second, the U.S. economy has a high level of technological innovation. Third, the U.S. economy has a strong and stable financial system. Fourth, the U.S. economy has a high level of government spending. Finally, the U.S. economy has a high level of private sector investment.

more, it is not clear that the failure to understand the role of the individual in the process of change and the role of social structure in the process of change is analogous to that between old scientific theory and contemporary theory that "does not work." Consistent with present scientific practice and procedure, it may be that a good theoretical approach has developed in the sciences in which (1) the role of the individual in the process of change is not as important as it once was, and (2) the role of social structure in the process of change is not as important as it once was. The result is that the old theory is not as useful as it once was, and the new theory is not as useful as it once was. This is the case in the social sciences, and it is the case in the natural sciences.

is a species of *Phragmites*. Edited by John Macdonald
Fig. 111. London and Edinburgh: Clarendon
University Press, 1970.

This book has become deservedly the standard English work on digital computers for the student and practitioner combining these two disciplines. It was the only comprehensive

Remembering that for the Kelvin scale the Fahrenheit degree is the method of measuring the change in t (physical temperature), the equation can be used whether t has a number value (in $^{\circ}\text{F}$). The only key word here is change, as measured the change of physical temperature, you will find that temperature is useful because it is the total of heat energy in your system, where you can still be operating and that includes the heat energy.

The Agency is located in a strategic
 Tenth Avenue building, and there are
 offices in various locations. The Agency
 has a large number of staff.

It was reported for testing subject to have

H. Langermann, *Centre for Political Studies, University of L. G. Maastricht, P.O. Box 616, 6200 MD Maastricht, The Netherlands*

[illegible]

A weekly outdoor board, usually composed of three people, is the major mechanism for communication between the board and the community. The board is responsible for the board's activities and for the board's relationship with the community.

For me an African art, sculpture was both sacred and profane. I tried it and as a young physician found it the perfect balance.

There is a structural variable, "Marriage," which has predicted the three dimensions of life satisfaction and was reliable as an index. Being married was the best predictor. Being single had a small effect on satisfaction rather than

as Captain Captain in 1950. He was promoted to the rank of Lieut. Colonel in 1952.

Raymond Commissioner William Bruce, B.S. 1920, 1922, 1925, 1927 and 2, and on December 17, 1952 aged 32.

William Bruce Barker was born on April 11, 1920, at St. Catharines, Ontario. He was educated at the Royal Military College, St. Catharines, Ontario, and at the University of Toronto. He was a member of the University of Toronto in 1941 and 1942, and attended the 2nd year of the University of Toronto in 1943.

Mr. Barker was with the Royal Canadian Mounted Police from 1941 to 1943, and then to the 1st Canadian Brigade, based in the United Kingdom. He was appointed to the rank of Captain in 1943, and then to the rank of Major in 1944. He was appointed to the rank of Lieutenant Colonel in 1945, and then to the rank of Colonel in 1946. He was appointed to the rank of Major General in 1947, and then to the rank of Lieutenant General in 1948. He was appointed to the rank of General in 1949, and then to the rank of Major General in 1950. He was appointed to the rank of Lieutenant General in 1951, and then to the rank of Major General in 1952.

The last service was in the Royal Canadian Mounted Police, where he was appointed to the rank of Major General in 1952. He was appointed to the rank of Lieutenant General in 1953, and then to the rank of Major General in 1954. He was appointed to the rank of Lieutenant General in 1955, and then to the rank of Major General in 1956. He was appointed to the rank of Lieutenant General in 1957, and then to the rank of Major General in 1958. He was appointed to the rank of Lieutenant General in 1959, and then to the rank of Major General in 1960.

Mr. Barker was a member of the Royal Canadian Mounted Police, and was appointed to the rank of Major General in 1952. He was appointed to the rank of Lieutenant General in 1953, and then to the rank of Major General in 1954. He was appointed to the rank of Lieutenant General in 1955, and then to the rank of Major General in 1956. He was appointed to the rank of Lieutenant General in 1957, and then to the rank of Major General in 1958. He was appointed to the rank of Lieutenant General in 1959, and then to the rank of Major General in 1960.

As a result of his long service to the Royal Canadian Mounted Police, he was appointed to the rank of Major General in 1952. He was appointed to the rank of Lieutenant General in 1953, and then to the rank of Major General in 1954. He was appointed to the rank of Lieutenant General in 1955, and then to the rank of Major General in 1956. He was appointed to the rank of Lieutenant General in 1957, and then to the rank of Major General in 1958. He was appointed to the rank of Lieutenant General in 1959, and then to the rank of Major General in 1960.

I visited him there first in 1941, and then in 1942. He was then in the Royal Canadian Mounted Police, and was appointed to the rank of Major General in 1952. He was appointed to the rank of Lieutenant General in 1953, and then to the rank of Major General in 1954. He was appointed to the rank of Lieutenant General in 1955, and then to the rank of Major General in 1956. He was appointed to the rank of Lieutenant General in 1957, and then to the rank of Major General in 1958. He was appointed to the rank of Lieutenant General in 1959, and then to the rank of Major General in 1960.

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WILLIAM BRUCE BARKER
New York Herald Tribune

Commissioner of the R.C.M.P.



William Bruce Barker, Commissioner of the R.C.M.P.

Mr. Barker, of the R.C.M.P., in the R.C.M.P.



William Bruce Barker, Commissioner of the R.C.M.P.

blackish-brown. The top part of the material is short and broad and very few nodules are seen. The top is recommended for opening and GP use. (200)

CANTLE SOCIETY

The Cantle Society is a medical society during that which participates the name of the Cantle Society also founded a number of such of 1900 which have formed the first rank of the Royal Army Medical Corps. (200)

The club has two floors each year and membership is open to any doctor who wishes to be admitted to the Cantle Society. (200)

The Cantle Society of the Society will be held in 1970 (London) in September 1970 and it is hoped that the Cantle Society of 1970 will be held in the Town of London. The Cantle Society of the Society (200) is a medical society. (200)



Source: *Journal of Management Education* 29(1), 2005, pp. 10-21. Copyright © 2005 Sage Publications.

EDITORIAL

In times when inflation has become the constant word heard on the radio and in newspaper headlines grows appreciably enough larger and those receiving little such aid as that person it is perhaps possible to take some small pride at the fact that the cost of the Journal has only increased by £1 a year over the last 40 years — since 1915. Putting this in another way it could be said that our reflections on previous editions that the Journal is now worth twice what it was 40 years ago and about 40 times as much as when it started. In view of this encouraging fact it is perhaps surprising that more serving officers do not take advantage of the unparallelled opportunity to subscribe to a magazine which offers so much for so little — and that has lasted this.

At a recent meeting of the Board of Management the future of many medical officers in uniform in their own person was widely commented upon. Medical officers with particularly favored because the recent response of dental officers to a request for more subscribers was most encouraging and their appeal is to see two interesting articles from dental officers on the same. It is certainly significant that several comments and many of those in training for such a status should not feel the need both to subscribe and to contribute to a journal whose job it is to quote from previous Board meetings to provide a medium for training in the manner of academic bodies current developments in naval medicine and present a cross section of what is being achieved. It is of value

both as a medium for training and in the moral education of the service as a whole.

Issues such as the present one in May of this year should attract complete attention of the professionals in naval medical organizations, the details of the guidelines on stress and depression in all medical and dental officers. However, the medical points, although smaller, contain equally significant papers and as a result of the Board of Management meeting it is now hoped to include abstracts of all articles published by serving officers who may not and not always quickly, want for personal value than that said. It is hoped that this will increase the interest of future issues.

It is appreciated that the message — the progress of health care delivered with volunteerism to the medical church organizations — is only likely to be heard by the concerned who may as a result feel encouraged to take a better than their attitude. Moreover, many of our subscribers have the responsibility for teaching younger officers and it is hoped that the message will be passed on to them. The experience of transfer and give is through in the telling.

Of one thing all of the Management Board serving were agreed. The quality of the Journal should be maintained as previously approved and as interests retained. It is above all a naval medical journal and the possible benefits of naval medicine are believed to be as relevant here as they are in other fields. If our subscribers tell the same to the Board of Management the future of the Journal will not be in doubt.

EXPERIENCE OF THE CORONARY CARE UNIT AT THE ROYAL NAVAL HOSPITAL, HASLAR, OCTOBER 1971 — DECEMBER 1972

R. E. Rowley

ABSTRACT

The coronary care unit at RNH Haslar is described, the management of patients outlined, and the results of treatment of 94 consecutive cases of acute myocardial infarction over a fifteen month period reported. As regards characteristics of the patients, aetiology and site of myocardial infarction, incidence of complications, mortality and causes of death the results are generally comparable to those of large published series. The incidence of various thrombotic, pulmonary embolic and supraventricular arrhythmias was perhaps higher than reported experience, and consequently some changes in management are suggested.

There is little hope of the irreversible factors of a subnormal reduction in mortality from myocardial infarct, complete heart block, or by preventing late sudden deaths. Effective treatment of ventricular fibrillation and possibly its prevention, reduce the consequences of coronary care, and undoubtedly reduce the hospital mortality of acute myocardial infarction. It is essential that a member of staff competent to defibrillate immediately is present in the unit at all times.

It is concluded that a purpose-built coronary care unit, sophisticated monitoring or alarm systems, and highly trained staff are not essential to provide effective coronary care.

INTRODUCTION

The majority of deaths from myocardial infarction occur within a few hours of on-

set (McNally and Penhance 1961; Fulton, Jelinek and Oliver, 1966) and many are caused by arrhythmias rather than severe myocardial damage. This knowledge, the development of an effective method of defibrillation (Lown 1962) and of efficient antiarrhythmic drugs have resulted in a proliferation of acute specialist coronary care units over the last eleven years. Many reports suggest that such units have been responsible for a reduction in the hospital mortality of myocardial infarction from about 50 per cent to about 13 per cent (Jelinek and Oliver, 1966; Koster, 1970; Brown and McMillan 1972).

Management of patients with myocardial fibrillation, and the fact that the survivors of such episodes have a prognosis no worse than that of myocardial infarction alone (Lown, 1969; McNamara *et al.* 1970) provide strong direct evidence of the efficacy of coronary care units, but the fact remains that this method of treatment has not been subjected to controlled studies, nor is it likely that such studies can be accomplished in the future (Kelly and Randall 1968). Indeed, the necessity of hospital treatment of myocardial infarction has been questioned elsewhere as of 1970 and it is not surprising that these inquiries in the medical and nursing professions a degree of skepticism towards the coronary care unit. As the maximum benefit from such units is achieved only by early and expert attention of patients with myocardial infarction it is left worth while to present an account of the coronary care unit at RNH Haslar and the results of treatment over a fifteen month period.

MATERIALS AND METHODS

Description of Unit

In 1969 one end of a male general medical ward was partially partitioned to form a makeshift coronary care unit of three beds. Apart from the partition and additional electrical power points there were no other modifications and the standards of lighting, space and patient privacy would be considered inadequate for a modern coronary care unit. With regard to instrumentation and staffing, the unit was considered part of the general ward. The main access to the general ward was through the centre of the unit.

Equipment

Monitoring equipment consisted of six open, open-end Cambridge Integrate EEG monitor oscilloscopes (Type No 2148). There were no automatic alarm devices, no central monitoring console and no data, tracing EEG facilities. A manual ground ECG defibrillator, also capable of synchronous cardioversion, which has been present in the hospital for some time, was used at the unit. A jetrolley with drugs, etc. for emergency situations and an emergency box with equipment for procedural procedures such as artificial ventilation and mechanical ventilation were the only other items of special equipment. Maintenance of the monitoring equipment was carried out by RME.

Staffing

Apart from any extra nursing order, the ward containing the unit had the same number and grades of staff as equivalent wards in the hospital. Two of the ward nurses had been trained as coronary care while serving in the GUMHS and from time to time worked with experience in coronary care prior to joining the Service ward unit. Thus during daytime hours there was usually an experienced nurse on duty but unfortunately during short

hours it was the rule for the unit to be covered by staff without experience of coronary care and therefore unable to defibrillate.

Staff below the level of nurse had no training other than that received while working in the unit but the knowledge and ability of student nurses and Medical Assistants have proved quite satisfactory in the circumstances. The unit was in no way intended to replace the coronary care service, and there was considerable lack of continuity in staffing often with loss of members of staff when they had achieved a valuable amount of experience.

Immediate defibrillation of ventricular fibrillation was performed by the ward nurse if the was trained in coronary care. As other units which were frequent requests depended on the effectiveness of without ventilation and trained cardiac massage the whereabouts of the duty physicians had perhaps most important, the doctors of the unit.

Criteria for admission to the unit

Agencies or cardiac patients, suspected of having sustained a myocardial infarction were admitted regardless of age at six Deyar infarction to the unit as a matter of urgency in without preliminary examination or ECG at the receiving hospital is recommended a policy reflected in the fact that only 50 per cent of all infarctions had acute myocardial infarction as defined below. Other patients were commonly had angina, acute coronary insufficiency, acute LVP, myocardial infarction of over 24 hours duration, pulmonary embolism acute pneumonia or pneumonia. Other diagnoses included heart failure, chronic disease, several spontaneous without collapse, dissecting aortic aneurysm and ruptured aneurysms, which a number of patients had undiagnosed chest pain. A few patients without myocardial infarction were admitted selectively or with myocardial

arrhythmias, tachycardia, poisoning, or for contraindications of chronic arrhythmias.

Management

Patients were monitored for at least 48 hours or until the rhythm was stable for at least 24 hours. Oxygen was given when given systemically. I/V shock in arrhythmias was, usually, Quinaprilone 1 M or 1 V was the preferred analgesic (Nagle and Fisher 1972) and Dantrolene was used for induction when resuscitation and anaesthesia did not suffice. An I/V drip of 0.5 valproic acid for urgent induction and was set up running free for at least 48 hours. Anti-coagulation was used only if there was a past history of thromboembolism or when a thromboembolic complication was suspected.

Management of complications

Left Ventricular Failure. Furosemide was used if there was any clinical or radio logical evidence of L/V. Diuresis was added when symptoms were present (dyspnoea, orthopnoea or hallognoea) or when the response to Furosemide was unsatisfactory.

Diarr. was treated with analgesic, oxygen raising the bed and treatment of arrhythmias when present. If the syndrome persisted despite these measures the patient was digitized and intravenous hydrocortisone and ascorbic acid were used if the condition deteriorated.

Postoperative Pulmonary Bleeds were treated by intravenous infusion of lignocaine, 1-4 mg per minute with or without bolus dose, at 70-100 mg if required according to the criteria of Lewis *et al* (1967) or more than 1 per centile indicated killing until the T wave re-appearing or more. Oral procainamide 250-500 mg six hourly was added if control was not achieved by lignocaine.

Postoperative Indications of sufficient duration to require treatment was not seen during the period of study.

Postoperative Bradycardia was treated by defibrillation as soon as possible (risk aspect followed by lignocaine infusion. Re-entry or rapidly occurring bradycardia was managed by trying to improve circulation and ventilation, correction of sodium and out of lignocaine and/or procainamide cautiously with repeated defibrillation.

Severe and persistent bradycardia was treated with atropine 0.6-1.2 mg I/V as required to keep the rate above 50/minute.

Supraventricular escape beats were not treated.

Supraventricular Tachycardias (SVT) usual P-R-T interval modified were treated with oral or intravenous digoxin and more recently with intravenous verapamil (Schumacher, Krüger and Garret, 1972). Episodes of supraventricular arrhythmias thought severe enough to warrant ventricular cardioversion were not seen.

Complete Heart Block the need was not stopped for intravenous pacing during the period of this study and treatment consisted of intravenous hydrocortisone, atropine (Heble, Adgey and Fainberg 1972) and if necessary, ascorbic acid infusion. On one or two occasions pacing by repeated blows to the precordium is used as effective assistance in respect of complete heart block.

Investigations

ECGs were recorded daily for three days then weekly.

Enzyme, SGOT and HDL daily for three days.

X-ray, portable chest on admission department film prior to discharge and further X-rays as clinically indicated.

ECG ESR were and electrolytes at least weekly.

WB, blood sugar, time hours post-prandial, cholesterol and triglycerides prior to discharge.

Table II Complications (other than arrhythmias)

Isolated Death	11
Shock X	4
Left Ventricular Failure	11
Severe L.V.F.	11
Congestive cardiac failure	14
Pneumothorax	11
Pericardial Tamponade	11
Pulmonary Embolism	11
Respiratory arrest	4

X Excluding shock caused by Arrhythmias

Table III Arrhythmias and Conduction Abnormalities

Sinus Bradycardia	17
Supraventricular Tachycardia	36
Atrial Fibrillation/Flutter X	11
Ventricular Tachycardia XX	14
Ventricular Fibrillation	13
Complete Heart Block	11
Total Heart Arrhythmias Y	48

X A further five cases had pre-existing atrial fibrillation

XX All were premature ventricular

Y Excludes sinus tachycardia and bradycardia because of clinical ill health, breathlessness and pulse < 50/min

Cause of death

No difficulty was found in ascribing a principal cause of death to each patient, and the causes of death are shown in Table V.

Discussion

Twenty-three episodes of ventricular fibrillation were observed in 12 patients and in 71 episodes sinus rhythm was established by defibrillation. Of the 12 patients only four of primary ventricular fibrillation

Table IV Morbidity Associated with Major Complications

Complication	No. of Cases	No. of Deaths
Shock	-	1 (33%)
Severe L.V.F.	11	1 (9%)
Congestive Failure	14	1 (8%)
Respiratory Ill	11	1 (9%)
Severe/Intractable Tachycardia	16	1 (6%)
Atrial Fibrillation/Flutter	11	1 (9%)
Ventricular Fibrillation	13	1 (8%)
CHB—Isolated Ischemia	7	1 (14%)
CHB—Anterior Ischemia	4	1 (25%)
Total > 1 complication	11	1 (9%)

there had no hospital or home history and eight survived to leave hospital. Six of the eight survivors had been employed prior to admission and had returned to their previous occupations. The other relevant features of dyspnoea following a prodromal period of symptoms while in hospital. One patient aged 47 was released before admission but it fit enough to the clinic and never less our and the final diagnosis, a heart attack was exclusively limited by extensive dyspnoea when that man

Table V Cause of Death

Myocardial Infarct	4
Complete Heart Block	3
Low Sodium Death	3
Primary Ventricular Fibrillation	1
Total	11

X Shock attributable left or right heart failure

Deaths and complications related to age

Table VI shows the number of deaths and instances of myocardial infarction in the different age groups, and shows the observed mortality as given in mortality reported on the assumption that all patients with myocardial infarction would have died had they not been admitted to the coronary care unit. It can be seen that patients over 70 years of age live fully, almost certainly following the fact that general practitioners advise patients of this age mainly because of serious complications. The important point from this table, however, is that the major impact of myocardial infarction on mortality is in patients under the age of 60.

DISCUSSION

It is intended to compare the results of this test with published data, hoping to detect and explain discrepancies and suggest alterations in patient management which might improve morbidity or mortality.

The main factors adversely affecting the individual prognosis of acute myocardial infarction are a short antecedent interval between coronary artery disease and myocardial infarction, hypertension and the presence of heart failure, shock or complete heart block (Faul and Sengle 1972). Examination of published reports from coronary care units (Parsons and Meyer 1968;

Goldstein 1971; Saville *et al.* 1972; Taylor *et al.* 1974) shows that the criteria for admission of cases and the frequency of the above adverse prognostic factors are similar to the present study and it is therefore valid to compare the results in this test with published data.

The incidence of complications is, in general, comparable to published figures: of low shock and LVP (Gibson and Hunt 1971) acute bradycardia, ventricular tachycardia, ventricular fibrillation, complete heart block (Miklos and Gibson 1973) and paroxysmal sub (Fischer and McKendrick 1973). Supraventricular arrhythmias, were more frequent than recent experience and bearing in mind the haemodynamic and thromboembolic hazards of these arrhythmias it is felt that evaluation of disposition for frequent administration escape beats should be introduced as a prophylactic measure (Bosterman 1973). Ventricular tachycardia occurred in 15 per cent of the cases, again higher than usually recorded (11 per cent Murray *et al.* 1970; 7 per cent Meyer *et al.* 1971) and 15 per cent Taylor *et al.* 1974). Thirteen per cent had pulmonary embolism and it is suspected that the early mortality of long standing may have contributed to the apparent high incidence. Patients with shock, severe LVP, prolonged asystole,

Table VI. Deaths and Patients Myocardially Infarcted by age

Age Range	Number of Patients	Number of Deaths	Number Myocardially Infarcted	Deaths as Mortality	Prognosis Mortality
< 50	31	3	1	7.4%	32.3%
51-60	34	5	4	14.7%	26.5%
61-70	31	4	1	12.9%	3.2%
71	4	4	0	10.0%	0.0%
Total	90	16	6	18.9%	21.5%

Note: Assuming all patients with myocardial infarction would have died

or cardiac arrest have been particularly at risk for pulmonary embolism, and it is now the policy to anticoagulate such patients. It is possible that earlier mobilization can help reduce venous thromboembolism (Buckley *et al.* 1970). It is known that calf vein thromboses occur at about one third of patients with myocardial infarction, usually starting within 74-98 hours of the onset of the illness (Gibson *et al.* 1970; Meyer *et al.* 1971). Handley, Dransos and Fleming (1971) feel it is unlikely that early mobilization could influence this. However, it is probable that mobilization predisposes to extension of the thrombus to the distal arterial system, from which the risk of pulmonary embolism is known to be high. As stated previously, the period of immobility has already been reduced to 15 days, and it would be safe and possibly beneficial from the point of view of thromboembolism to reduce this further (Rayson 1977; Boyle *et al.* 1971; Taylor *et al.* 1973).

The mortality of 10.5 per cent compares well with the published series referred to above. Eight of the 15 deaths were attributed to myocardial failure (block and/or unstable heart failure). These patients died on average 17 days after admission (range 2-66 days) and at one pulmonary embolism was a contributing factor.

As mentioned above, such patients are now anticoagulated routinely. Myocardial failure remains the major cause of death, as all published series and it is generally recognized that present methods of management, particularly of shock, are of little avail in a situation where the prime problem is extensive myocardial damage. A surgical approach seems to offer the only hope of salvage from this group of patients in the near future (Mittelman 1971) and considering the underlying pathology, it would seem unreasonable to expect too much from this.

Late sudden death is also a separate

problem, considered by some to be largely due to toxic reactions (Pryor and Mayne, 1969) (Spencer *et al.* 1969) and by others due most commonly to arrhythmias (Thompson and Staines 1971). These patients in this series died suddenly late in their hospital stay due to the death of heart infarction proved at post mortem. The other two of myocardial infarction of which the cause was not clearly determined. A point of interest is that these patients were observed from ventricular fibrillation after leaving the coronary care unit and at two of these pulmonary embolism was strongly suspected as the precipitating event.

Five patients were at complete heart block at the time of death, but in two the conduction disturbance was clearly shown only to be temporary before leaving these patients stabilized in complete heart block. The poor prognosis of complete heart block particularly with anterior myocardial infarction (when it often indicates effective narrowing of all three branches of the intraventricular conducting system) is well known and is related in Table IV. There is no firm evidence that artificial pacing has improved the prognosis of complete heart block complicating myocardial infarction and indication for this form of treatment has varied considerably (McIntosh 1970). Furthermore, the majority of patients surviving complete heart block with anterior infarction die within one year (Johnson 1971; Chamberlain 1971). Of the four patients dying in this series, one had anterior infarction, one had anterior and inferior infarction with a ruptured papillary muscle (evidenced at post mortem) and the third was a woman of 77 with inferior infarction. The last one now undergoes transvenous pacing, but it can be inferred from past results that little improvement in survival mortality can be expected although it is likely that the conduction system will benefit from the pro-

colours.

The final deaths were caused by primary ventricular fibrillation in a woman aged 48 years. It came after admission with a doubtful myocardial infarction. Under tentative defibrillation was delayed and when applied reached its apogee. Although the overall figure of 89 per cent survival for treatment of primary ventricular fibrillation is very respectable compared to published results there can be little doubt that this was a preventable death.

It seems clear from Table VI that mortality has been reduced by defibrillation and it is possible that it is further reduced by antiarrhythmic treatment (Gunn *et al.* 1967). It also seems clear from the foregoing discussion that the salvage of a patient with myocardial failure complete heart block or late ventricular fibrillation by improved management will be a relatively uncommon event, and therefore, that the chances of successful coronary care in the prevention and treatment of primary ventricular fibrillation. The main adjustment in present management that appears to emerge from this study would be to ensure that a Sarnet or Sarnet-Martin treated by defibrillation immediately be treated in the final as all cases. Prolonged use in the long run more important than machines in the avoidance of preventable deaths.

Finally, the close comparability of these results with those of published series suggests that effective coronary care can be achieved in makeshift surroundings and with makeshift staffing and equipment. The main problems apart from that of staffing, have been things like inadequate space and lighting, lack of paper, oxygen etc. and these have been solved recently when an improved unit of cardiac design was introduced from a different medical unit. The capital outlay and running costs for the coronary care unit have been, by any standards, a pittance.

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NORTHERN IRELAND — FEBRUARY TO JUNE 1973

T. Pace

ABSTRACT

February 1973 saw the deployment of 42 Commando RM to the same area of Belfast that was covered in the preceding June by 40 Commando RM. The purpose was the containment of Internal Security threats. The total area covered by the Unit increased approximately thirty square miles, yet all of the casualties, with the exception of those occurring in a traffic accident, happened over an area of one square of a square mile.

The battle area was that of the New Lodge, a Republican selected stronghold. The tactics employed by the urban guerrilla during this time were those of the hidden bomber and the hit-and-run gunman.

By the end of the year in June, the calculated number of rounds of ammunition fired at the Unit was two hundred and twenty eight, and sixty bomb incidents had been dealt with. Two deaths and over a score of injuries were suffered by the Unit in this time.

Organisation of the Military Medical Unit

The Commando Medical staff comprised one MD and CPOMA, an LMA, MA, and two drivers. The Unit was deployed in five different company locations throughout the area, and at each of these locations was placed a Medical Assistant to cover routine medical work. The MD and remaining staff were located at the Regimental Aid Post situated at Galloway Park, in a camp in the grounds of the British Army headquarters. It was from here that we were called to the casualties in the streets.

Vehicles

The ever changing situation in Belfast

had led to a change back in the number and in the role of the ambulances, and also compared with the period during which 40 Commando was in command (Gordon, 1973).

1. Long wheel-based Land Rover ambulances. This is a three square metre, 4x4 open passenger vehicle. We found this to be light on all our control in the mountainous area.

2. Medium commercial ambulances. This type included 15 tonne trucks provided with air. It was seldom used as it is not easily manoeuvrable and is too cramped within the urban area in working. It was reserved in case of a call for a large scale gas leak, or in case of a call to evacuate casualties from a large indoor area.

3. Land Rover. This is a five seat van. Most urban personnel vehicles in use used this style means. They, however, company leaders, had paid little use.

Casualty Procedures

When a casualty occurred the MD or CPOMA, directed to the injured area with a driver and sometimes the RMP LMA. The RMP member was at the RMP to cover the possibility of further casualties occurring during the period of involvement of the first team.

In order to reduce time and cover the casualty to hospital with a minimum of delay, several procedures were adopted during the time.

1. Two medical centres formed into the Unit centrally, and allocated to the RMP (British Army), have a full time staff who kept in all times in contact with the RMP. At least one medical team was always available, available. When on the night a teaming or clearing, or relief was found to occur, the available, first team would be in use. This worked from my report to go out a few more times than was necessary. But it meant that other casualties (accidents) were usually able to reach their medical treatment.

2. A third group of the unit and a report were carried in such vehicles, so that the medical personnel could reach casualties in the 10 miles.

3. All time and equipment, with the exception of mechanical efficiency and first aid kit, were in portable form in each ambulance.

stream away. Later that night he underwent bilateral end-typh vagotomies at the Royal Victoria Hospital. Over the next few days a worsening degree of diarrhoea was treated into capsules which, together with the developing liver and confusion was perhaps symptomatic of the gastric gross facili outgrowing within the left stump. Over the following days the stump taken to completely together was treated. He was treated with appropriate antibiotics hyperbaric oxygen and two additional dissections of the stump. Eventually, the liver and confusion subsided in the operation was successfully concluded. The diarrhoea did not subside and despite the severity of the operation it made into action almost from his face. He is now progressing well in the R&F rehabilitation unit. Two others were injured in the same blast, receiving lacerations only. One was injured seriously enough to require hospital admission, but the lacerations have since healed and he has returned to duty. The other had only minor lacerations.

Over the remainder of the tour seven people were treated for gunshot wounds. In about three were treated by debridement and closing of the bullet track followed by delayed primary closure or dressing by secondary intention, depending upon the extent of the wound. Surprisingly few of these wounds were complicated. One injury was due to the anterior aspect of the right thigh by a high velocity missile. The bullet entered through the right buttock creating a large exit wound, but all vital parts between entry and exit remained intact.

A Bombardier was shot in the back by a high velocity missile at a range of only a few hundred yards, yet somehow the wounds that he received sustained relatively superficial.

A 20 year old Lance Corporal who was on a foot patrol was shot again by a high velocity weapon. The bullet passed through

the left arm fracturing the ulna and severing the ulnar nerve. It then entered the abdomen via the left iliac fossa, where it fragmented causing an intra-abdominal drainage (Figs 1 and 2). The wounds have now healed, the fracture has set and the ulnar nerve has nearly been restored.



Fig. 1. Fragmentation.

On the evening of April 16 a sign reported that a bomb had been placed inside a building in the Dux area. It was investigated and found to be a hoax. As the platoon who were concerned with the investigation left the site, an alarm period, watching the proceedings at a distance, detected a 20 lb bomb which had previously been placed inside a building next to which a corporal was now standing. The corporal was injured by shrapnel but as he lay unharmed was found to have escaped with help-treated lower thoracic vertebrae three fractured ribs, and a fractured ulna etc. He has now returned to light duties.



Fig. 1. A Marine killed in the first attack.

On Tuesday April 17 the Provisional IRA staged their first (RPT 7) (Rearm) mortar rocket attack on the Line. It caused a firestorm initiated etc by incendiary rockets, and exploded on a wall behind. The force of the explosion forced the driver out of the vehicle but fortunately he escaped injury. That was among the walls and windows of the RAMP close to the sound of a nearby explosion and caused commotion amongst the occupants. Mortars came in a building just alongside the camp a bomb scare had been declared a hour by the local Constabulary. As a result of Marine advanced on the building, the bombs continued later in being between 70 and 80 the declared itself not a bomb and went off. The men were caught by the Irish Marine tank units the road and prepared with flying glass and debris. The first injury in the use of the tank gave constant observation to areas the state of the system. One again has had been

land, and all the injuries had been minor. All men were able to walk and as they were handed into the ambulance, stopped back to the RAMP and around three.

On Sunday April 21 the first vehicle of two in a mobile patrol slowed down to cross over a stream, ramp in the New Lodge Road. The camp had been created by the Unit a few weeks earlier to prevent the local mobsters from being shot at or treated from their spending money cars. Guards in a house overlooking the ramp noted the arrival of the first vehicle and avoided the arrival of the second. As the second vehicle slowed to cross the ramp the company MA who was travelling in the rear of the vehicle happened to be looking up at a window when he appeared as if in the same position the Marine shot to the MA, jumped forward the sound of gunfire filled the streets, and someone else yelled that he had been hit. The Unit suffered an instant fatal injury like first was in a rather constant matter earlier. The 19 years old Marine next to the MA had been shot in the heart. He died instantly from massive transfusion haemorrhage. In this time almost a car's petrol was shot in the left leg. The bullet shattered both the ribs and the spine and he is still under orthopaedic care. The left leg of the MA was lightly popped with shrapnel and he was admitted to Margrave Park Hospital a few days later for removal of a small fragment of metal from the leg.

The Unit continued its difficult work over the coming weeks and despite frequent visits in and over 100 incidents of shrapnel were fired at the Unit in one hour in other rocket attack and many more about one and bomb shrapnel, no more casualties arose.

Other than routine medical work, the MO in Belfast has also to perform medical examinations both before and after the questioning of all people who are detained or arrested. This is normally a routine

A PERSONAL APPROACH TO THE TREATMENT OF VERRUCAE

R. H. Thompson

ABSTRACT

Verrucae or warts of the sole are naturally stubborn to all forms of treatment. They tend to recur and as many as 20 per cent may show this tendency. The many methods of dealing with them, ranging from the orthodox to Tinsley's new method of burying a steel nail in the Church graveyard at midnight, are in themselves an admission of failure leading to frustration in both patient and doctor alike. In a minority of cases superficial X-ray therapy is tried as a last resort and should this fail the unhappy patient resorts to medical plaster, chiropody and finally to treating himself. It is true to say whilst no patient likes having verrucae, no doctor enjoys treating them.

After many years of sharing the patient's disappointments with lengthy trials of an uncomfortable and often painful benzoin soles, podophyllin resin and other methods I now consider that the only sure and unobtrusively quick approach is subcutis incision under local anaesthetic. A general anaesthetic is rarely needed for such a simple procedure. The only contra-indication is cancer, or when the sole is infected with so many warts that there is hardly any normal skin visible. A week later when most scars have healed other methods must then be tried but prognosis is poor and sometimes treatment has to be given up. There is not a fair to cure rate provided that the edges of the wound can be approximated by suture.

A verruca is a deeply implanted virus infection, often solitary on the ball of the foot, plantar surface of the toes or on the heels, and it is extremely rare to see one on the dorsum of the foot. It poses much danger on the sole than on the heel be-

cause of the direct pressure of walking and this is a cause of high recurrence rate due to incomplete removal. Sometimes a group of so-called mosaic verrucae occur with small scattered median seedlings and these have a bad reputation for recalcitrance in all forms of treatment. There is no doubt that whole groups of verrucae may disappear quite dramatically and for some years warts on the hands are more likely to do this than those on the foot. The reason for this may be temporary immunity but attempts to cure by producing an auto-vaccine have been disappointing.

Recognition of a verruca is easy. A discrete dark keratinized area with small deep dark points due to vertical vascular loops is seen. There is not the diffuse yellow waxy look of a callus though the two are often associated. Characteristically pain is experienced on side to-side pushing as well as with direct pressure but some are curiously completely painless.

The patient is apprehensive at the prospect of a needle entering the sole of his foot for it is a primitive reflex to walk down. His confidence is gained by explaining the procedure in advance. He is told he will experience discomfort returning to right pain as the needle enters but that is all. Therefore the operation will be painless provided he co-operates. As soon as he feels discomfort he must not jerk his foot away suddenly but say 'hang' and of course this must be repeated. The whole sole is cleaned with Sterseptol Spray and Elyol Chloroide spray is dangled to put above the site. On releasing the spray must cease or foot will appear on the syringe nozzle and block it. Magnifying surgical spectacles are worn

for it is necessary to be close up to the verruca. Three mL of 1 per cent plain Lig. caerulea are injected through a 25 gauge needle. The procedure should be slow. This gives the required analgesia and coagulation from the patient although anaesthesia is almost immediate. The constant hand motion the needle down to prevent oscillatory movement.

At an angle of 45° the needle is slowly and gently introduced a few millimetres below the edge and to a depth of one third of the needle length only. A small amount is injected under pressure. The needle must be firmly attached. After a few seconds pause the needle is quickly moved in to its full depth without further introduction of anaesthetic. This second point of inserting the needle produces no pain whatsoever. It is only on the superficial layers of the thin flat pain is experienced. Any later pain is caused by tension and pressure of the anaesthetic fluid used. Provided that the anaesthetic is very close and the patient agrees for the purpose in step of each stage there will not be subsequent pain and total anaesthesia is achieved.

The tip of the needle now lies below the centre of the root. Slowly the needle is withdrawn, the last 0.5 mL being reserved for the superficial layers of the verruca itself. This last always produces a little pain and the patient is warned of this. This 'drop-out' technique is essential for satisfactory results and is so much a part of the operation as the next stage.

A vertical cylinder of tissue is then removed following the outline of the edge of the verruca down to subcutaneous fat. After making the superficial incision with a small bladed hook the verruca is grasped with toothed metal forceps and the hook cut continued down to the verruca is pulled up gently out of its bed (Fig. 1). Gentle traction is maintained, the entire verruca gradually extending helped by the pressure



Fig. 1. A small 1 cm. x 1 cm. verruca is pulled out of its bed.

of the anaesthetic fluid. The verruca is removed a tooth with a surprisingly long pediment against root. If the root does break off success is not assured for the remainder has to be removed processed with blood sealing up. Deep fat is plainly visible after removal (Fig. 2). The sides



Fig. 2. Verruca removed leaving deep fat.

PRIMARY IRRITANT DERMATITIS FROM THE MANCHINEEL TREE (*HIPPOMANE MANCINELLA*) IN THE EASTERN CARIBBEAN

N. J. Linn

ABSTRACT

Five cases of primary irritant dermatitis following exposure to the Manchineel tree are described and an attempt is discussed the nature of the toxin has been made from the existing literature. Exposure occurred during a surveying mission in the Eastern Caribbean.

Clinical Details History

Five men were serving on HMS Fox and HMS Foxon presented on the same day with the complaint of severe burning contact skin rashes which had begun after they had returned to their ships following a beach barbecue the previous evening. From the history it was clear that during the course of the evening they were all exposed to a similar toxin.

Further investigations revealed that all five had sat under Manchineel trees bordering the beach and a fuller history had revealed that four of the patients had normally been sunbathing had returned to the beach, sitting or lying under the tree hood fringe of the beach for approximately half an hour before drinking and had allowed themselves to dry in the sun. The fifth patient had remained sitting on the beach and had remained clothed in long trousers and a short sleeved shirt.

There was no other relevant history. One patient had a short childhood history suggestive of atopic eczema but there was no recent history of skin disease or any of the patients. None were taking any drugs and had otherwise been quite well. None had actually touched the toxic leaves or fruit.

Findings

Each patient had developed an erythematous skin eruption with vesicles, small bullae and oedema. Surrounding the areas of inflammation were areas of erythema. The four patients who had been bathing had rashes on the back of their bathing trunks and had variable skin areas involved over the exposed areas. The other patient's skin eruption was confined to the forearm (Fig. 1).

None had any systemic disturbances nor histamine or oral symptoms.

The diagnosis of a primary irritant dermatitis was made. Later investigations confirmed the Manchineel trees under which they sat as the probable source of irritation.



Fig. 1. Skin eruption on forearm.

Monograms

The consisted of local application of Potamon Potamogeton tuberosus 0.0005 in grams units followed by Hydrocortisone 1000 units 1 per cent BPC. The acute vascular stages resolved over 24 to 48 hours and the subsequent erythematous and excoriated lesions resolved over 3-5 days. Two cases required additional antibiotic with Chloramphenicol tablets to relieve associated pyrexia.

Discussion

The Marchantia sp. (Hippocrepis) man conflict is extremely well known in the West Indies and Central America being due to the genus Euphorbia having a milky sap. Several references have been found to the older literature.

John Taylor (1843) writing as Taylor on Florida, p. 213 says of Euphorbia: "This is a poisonous the saporous extract of a genus of plants which have a milky juice and are known under the genus Euphorbia. The stigma contains nearly half as much of an acid resin which acts as an irritant producing greasy pain and discomfort. After death the mucous membrane of the stomach is found inflamed."

He was probably referring to the effects of eating the fruit, which I shall deal with later.

Chambers' Treatise on Poisons (1844) page 392 contains a paragraph with Marchantia. The Marchantia — a plant which contains a milky juice which is poisonous of very acrid properties.

Two drachms of the juice applied to a wound in a dog will cause death in 10 hours; by rubbing cellular inflammation; and half tea, quantity will prove fatal to man, human when introduced into the stomach inflammation is excited wherever the juice is applied even in small doses. But Reissner (1844) shows the generally received notion that further effects come from sleeping

under the branches of the tree or swimming, moisture from the leaves. This notion has, however been adopted by recent authors.

That the tree can cause a primary irritant dermatitis from a direct effect on people, resting under the tree is accepted by Gay (1930) and that the leaves would contain this substance.

The Caye Indians brought photographs of the island and the map as an access point. All parts of the tree are poisonous but the strong veins between geographical location and points to points on the map in the region. The milky sap is extremely irritant and causes severe skin eruptions. It also may cause respiratory and connective tissue with subsequent blood poisoning. Allen (1940) giving Sumner's account of the usage of 1945. While Sumner's account that some of the ships carpenters were blinded temporarily by the sap getting in their eyes whilst eating the tree.

Unfortunately not a great deal of work has been done to determine the nature of the toxin involved and it is likely that more than one active principle is involved and, reaction to contact with the plant is not exactly comparable to reaction to ingestion of the fruit which may produce pharyngitis, oesophagitis, gastritis and necrosis on entrance. Deaths have been known following fruit ingestion.

Pharmacological investigation of the tree fruit has led to the isolation of an alkaloid which directly irritates the pharynx and causes oedema. The extraction of benzoin by steam distillation of the leaves and of an alkaloid from the distillate extract of the leaves has also been reported (Langworthy 1954; Langer and Fock, 1955; Schaefer, Langer and Fock 1954; Langer Fock and Schaefer 1955).

Description of the tree and fruit

This is a large branching evergreen tree which may grow to a height of 40 feet

or more (Fig. 2). It has a smooth grey bark and is usually well branched. The individual leaves are oval shaped and approximately 4.7 cm in length. The tree has a grayish yellow wood with apple appearance with a diameter of approximately 4.5 cm (Fig. 3).



Fig. 2. *MANCHINEEL TREE*

The trees are mainly found fringing the edges of the sandy Caribbean beaches and also along the banks of rivers and creeks.

Stokely and Werts describe an occurrence of Manchineel tree dermatitis in American servicemen on the Caribbean islands amongst which there were also some cases of contact dermatitis. Also there were reports of personal dermatitis following the use of Manchineel tree leaves as kind of toilet paper¹ (Stokely and Werts 1942).

Conclusion

Some of the Post Graduate, to the West Indian Islands refer to the Manchineel



Fig. 3. *Manchineel Bark*

tree, recommending avoidance of trees known or just some confirm the tree with the well branched habitless that the local children tell. No reports in the past described the tree or fruit are was a mark, clear that the neighborhood of the tree, it will be avoided.

The first persons involved and myself went well aware of the warning, on paper about the tree but had no first hand idea of what a Manchineel tree looked like and after their dermatitis had appeared and we had noted the bark and examined the tree concerned.

The next of cases is reported to have been [Royal Naval Medical Officer with the Island and states that physical contact with the tree or fruit is not essential to produce a Primary Irritant Dermatitis. In process of the fruit would clearly be extremely hazardous.

I would like to thank the Captain, Royal Historical Gardens, Barb. for information on the Manchineel tree and am indebted to Surgeon Captain P. J. Perrow for his advice and encouragement.

MICROBIOLOGICAL STUDIES IN SUBMARINES Ecology of *Montipora* in Symptomatic Cases

F. H. Stanton, R. J. Fallon and R. T. Lerner

ABSTRACT

Microbiological surveys of the crews of both Royal Navy and United States nuclear submarine crews, who were exposed to extended periods in an isolated environment, revealed an unexpectedly high level of microphytological metazoans when selective media was used and no, in fact, accomplished increases in the level of resistance of the organisms to sulphadiazine during the period of patrol.

Results from British and United States personnel showed very similar faunal communities, with the exception of nematode groups and ciliophorans community.

Introduction

Recent results collected from the crews during the first commission of a Royal Navy Polaris submarine gave a level of about 25 per cent for the faunal index of metazoans (Rapport 1969) and it was suggested at that time that this level may have been due to crews having recently visited the United States where the more rigorous faunal index was considered to be higher than that in the United Kingdom. Attempts to repeat the high isolation test in other Royal Navy submarines were unsuccessful.

The primary objective of this study was to determine the faunal index of *Helicovera metazoica* in the microphytology of two crews of HMS *Argonaut* prior to and on return from a training period in the United States.

Three secondary objectives were:

1. To identify all faunal cultures and test for the degree of sulphadiazine sensitivity.

2. To study faunal index changes by sub-sequent microphytological sampling at regular intervals.

3. To compare results found in HMS *Argonaut* crews with those on Polaris submarines of the United States Navy based at Holy Loch, Scotland.

Personnel

Both crews of HMS *Argonaut* were based in Foulness in the Clyde Submarine Base. When not on patrol cycles, crewed men usually lived with their families in the Harlandsburgh area and single men were accommodated in modern quarters living quarters in the Navy Base. Lower of these two levels duration was taken coinciding approximately one week after faunal index of patrol. Crew members therefore came into close proximity to each other for morning and sleeping only during their patrol period.

Commissions of crews in the United States Polaris Force at Holy Loch were in the main similar to those in the Royal Navy at Foulness with the exception that US crews remained on board their submarines at Holy Loch for a few days after patrol whilst crew turnover was accomplished.

Materials and Methods

All samples were taken by the same person using plastic tubes with no wooden applicators which prior to disinfection by autoclaving were broken near the end and used to form an angle of 90° thus facilitating the taking of flow from the posterior microphytological wall directly behind the orifice.

crystalline specimens, the crystals were taken using an air gun. These assembled and the entire 'reaction' compartment in the chemical synthesis plant.

Seeds were produced in a premolten process that includes a sugar (Duffin & Hume, 1991) containing the 'suspension' (4) up. Culture (90 mg) Nucleus (130 mg) per 100 ml of solution (VCM solution 100, Maryland 100). When all the glass had been assembled they were taken to the laboratory and checked using a standard lamp then incubated at 17 °C in 5:10 per cent CO₂ for 10 to 14 hours.

All cultures were examined for media-positive organisms which were then fixed and examined using Gram's stain. All Gram-negative diplococci were subcultured onto MacConkey broth and subsequently on to the same agar slants for testing of fermentation of glucose, lactose, sucrose, inulin, and ONPG (O-nitrophenyl-β-D-galactopyranoside). Organisms which were double positive (Gram-negative, diplococci and fermented glucose and lactose but not inulin) and ONPG were considered to be *N. meningitidis*.

Membrane gas were developed by using culture produced in MacConkey broth to subgroups A, B, C, D, X, Y, Z, P, ME, 100 and 1000. A Microtitre agglutination technique was employed as used by Duffin & Hume (1991). Mixed strains which could not be grouped by standard agglutination techniques were grouped by serum complementation using a local suspension of antigen.

Subsequently, sensitivity was tested where possible using MacConkey broth plus streptomycin concentrations of 0.01 mg/100 ml (0.1 mg/100 ml), 1.0 mg/100 ml (1.0 mg/100 ml), 10 mg/100 ml (10 mg/100 ml) and 100 mg/100 ml (100 mg/100 ml). Growth of organisms was observed on more than 0.1 mg/100 ml inhibition is indicative of resistance growth on 0.1 mg/100 ml has not 1 mg/100 ml was taken as indicating partial resistance

and growth upon 1.0 mg/100 ml alone was interpreted as sensitive to cephalosporins (Feldman, 1987).

Conditions and Sampling

The pre-patent sampling of 1985 from James Port and Stobhill areas was carried out within three weeks of each other under very satisfactory conditions. On both occasions the sampling dates were set up in stone, primarily in the working area of the stone and machine factories were close at hand in the back quarters of the Stobhill area.

The post-patent sampling of both 1985 *Stobhill* areas was carried out together about 15 weeks after the previous survey (this being the first opportunity to do so due to operational and leave requirements).

A profile study of unemployable menageons in United States (Peters) per se was carried out in a subsequent year based at Holy Loch Scotland over two successive periods.

Conditions of sampling of the US per se were defined in only one respect from those used at the Clyde Stobhill area. Due to the distance between the Holy Loch and laboratory facilities in Glasgow the incubated plates had to be transported about 30 miles by ferry and road.

The post-patent sampling of US persons was carried out about 13 weeks after the first sampling. Due owing to operational commitments fewer persons were available for sampling.

Results

The detailed results are given elsewhere (Duffin, 1990). Table 1 summarizes the important findings.

No significant difference in isolation rate was found between the two areas of Holy Loch and Stobhill (X² = 0.01, P > 0.05) and the results in Table 1 are for the combined areas. The pre and post-patent isolation rates for these personnel are not significantly

Table 1

The estimates (with 95% lower and 95% upper bounds) of the true population prevalence of measles in the United States, based on the results of the 1955 and 1956 surveys.

	1955 Survey		1956 Survey		Combined	
	$\frac{100}{100} \times \frac{100}{100}$	$\frac{100}{100} \times \frac{100}{100}$	$\frac{100}{100} \times \frac{100}{100}$	$\frac{100}{100} \times \frac{100}{100}$	$\frac{100}{100} \times \frac{100}{100}$	$\frac{100}{100} \times \frac{100}{100}$
MMR Resolution	$\frac{100}{100} \times \frac{100}{100}$	$\frac{100}{100} \times \frac{100}{100}$	$\frac{100}{100} \times \frac{100}{100}$	$\frac{100}{100} \times \frac{100}{100}$	$\frac{100}{100} \times \frac{100}{100}$	$\frac{100}{100} \times \frac{100}{100}$
USS Non-Stratum	$\frac{100}{100} \times \frac{100}{100}$	$\frac{100}{100} \times \frac{100}{100}$	$\frac{100}{100} \times \frac{100}{100}$	$\frac{100}{100} \times \frac{100}{100}$	$\frac{100}{100} \times \frac{100}{100}$	$\frac{100}{100} \times \frac{100}{100}$
Both Surveys	$\frac{100}{100} \times \frac{100}{100}$	$\frac{100}{100} \times \frac{100}{100}$	$\frac{100}{100} \times \frac{100}{100}$	$\frac{100}{100} \times \frac{100}{100}$	$\frac{100}{100} \times \frac{100}{100}$	$\frac{100}{100} \times \frac{100}{100}$

usually different ($\chi^2 = 1.15$, $p = 0.05$).

An apparent rise in measles incidence in the USS Post-Survey area is shown from the first period but not reported for the second period and in two post-survey regions for this area, were also not likely due to the small number of persons available for sampling. The slight decrease in measles rate in areas from period for the combined values in Table 1 is not statistically significant ($\chi^2 = 1.11$, $p = 0.05$). The overall results for the rates of MMR Resolution and USS non-stratum are therefore similar to both pre- and post-survey periods and yield an incidence rate of 25 per cent for the complete survey.

The results of subgroup grouping of the strata included are summarized in Table 2.

In both United States Navy and Royal Navy personnel Group B-V, measles-like disease predominates and the incidence rates are similar. The most complex group, viz. pattern found in the RN crew, pre-survey was sampled in post-survey surveys (1956-1957).

Similar results in subgroups of strata were noted in the data of both ships with no increase in the measles-like disease and partially resistant strains following period. The numbers involved are small but it may be significant that in completely resistant strains were recorded in the pre-survey surveys in the first six years and in only 2.08 of the American

Table 2

Subgroup grouping of strata of 1955 and 1956 surveys. The results of the survey are given in parentheses. The results of the survey are given in parentheses.

Subgroup	1955 Survey (n = 100)	1956 Survey (n = 100)
1. (1955)	100 (100)	100 (100)
2. (1956)	100 (100)	100 (100)
3. (1957)	100 (100)	100 (100)
4. (1958)	100 (100)	100 (100)
5. (1959)	100 (100)	100 (100)
6. (1960)	100 (100)	100 (100)
7. (1961)	100 (100)	100 (100)
8. (1962)	100 (100)	100 (100)
9. (1963)	100 (100)	100 (100)
10. (1964)	100 (100)	100 (100)
11. (1965)	100 (100)	100 (100)
12. (1966)	100 (100)	100 (100)
13. (1967)	100 (100)	100 (100)
14. (1968)	100 (100)	100 (100)
15. (1969)	100 (100)	100 (100)
16. (1970)	100 (100)	100 (100)
17. (1971)	100 (100)	100 (100)
18. (1972)	100 (100)	100 (100)
19. (1973)	100 (100)	100 (100)
20. (1974)	100 (100)	100 (100)
21. (1975)	100 (100)	100 (100)
22. (1976)	100 (100)	100 (100)
23. (1977)	100 (100)	100 (100)
24. (1978)	100 (100)	100 (100)
25. (1979)	100 (100)	100 (100)
26. (1980)	100 (100)	100 (100)
27. (1981)	100 (100)	100 (100)
28. (1982)	100 (100)	100 (100)
29. (1983)	100 (100)	100 (100)
30. (1984)	100 (100)	100 (100)
31. (1985)	100 (100)	100 (100)
32. (1986)	100 (100)	100 (100)
33. (1987)	100 (100)	100 (100)
34. (1988)	100 (100)	100 (100)
35. (1989)	100 (100)	100 (100)
36. (1990)	100 (100)	100 (100)
37. (1991)	100 (100)	100 (100)
38. (1992)	100 (100)	100 (100)
39. (1993)	100 (100)	100 (100)
40. (1994)	100 (100)	100 (100)
41. (1995)	100 (100)	100 (100)
42. (1996)	100 (100)	100 (100)
43. (1997)	100 (100)	100 (100)
44. (1998)	100 (100)	100 (100)
45. (1999)	100 (100)	100 (100)
46. (2000)	100 (100)	100 (100)
47. (2001)	100 (100)	100 (100)
48. (2002)	100 (100)	100 (100)
49. (2003)	100 (100)	100 (100)
50. (2004)	100 (100)	100 (100)
51. (2005)	100 (100)	100 (100)
52. (2006)	100 (100)	100 (100)
53. (2007)	100 (100)	100 (100)
54. (2008)	100 (100)	100 (100)
55. (2009)	100 (100)	100 (100)
56. (2010)	100 (100)	100 (100)
57. (2011)	100 (100)	100 (100)
58. (2012)	100 (100)	100 (100)
59. (2013)	100 (100)	100 (100)
60. (2014)	100 (100)	100 (100)
61. (2015)	100 (100)	100 (100)
62. (2016)	100 (100)	100 (100)
63. (2017)	100 (100)	100 (100)
64. (2018)	100 (100)	100 (100)
65. (2019)	100 (100)	100 (100)
66. (2020)	100 (100)	100 (100)
67. (2021)	100 (100)	100 (100)
68. (2022)	100 (100)	100 (100)
69. (2023)	100 (100)	100 (100)
70. (2024)	100 (100)	100 (100)
71. (2025)	100 (100)	100 (100)
72. (2026)	100 (100)	100 (100)
73. (2027)	100 (100)	100 (100)
74. (2028)	100 (100)	100 (100)
75. (2029)	100 (100)	100 (100)
76. (2030)	100 (100)	100 (100)
77. (2031)	100 (100)	100 (100)
78. (2032)	100 (100)	100 (100)
79. (2033)	100 (100)	100 (100)
80. (2034)	100 (100)	100 (100)
81. (2035)	100 (100)	100 (100)
82. (2036)	100 (100)	100 (100)
83. (2037)	100 (100)	100 (100)
84. (2038)	100 (100)	100 (100)
85. (2039)	100 (100)	100 (100)
86. (2040)	100 (100)	100 (100)
87. (2041)	100 (100)	100 (100)
88. (2042)	100 (100)	100 (100)
89. (2043)	100 (100)	100 (100)
90. (2044)	100 (100)	100 (100)
91. (2045)	100 (100)	100 (100)
92. (2046)	100 (100)	100 (100)
93. (2047)	100 (100)	100 (100)
94. (2048)	100 (100)	100 (100)
95. (2049)	100 (100)	100 (100)
96. (2050)	100 (100)	100 (100)
97. (2051)	100 (100)	100 (100)
98. (2052)	100 (100)	100 (100)
99. (2053)	100 (100)	100 (100)
100. (2054)	100 (100)	100 (100)

isolates obtained in the post paired survey. They were 2/36 and 4/16 respectively.

There was little change in the carriage of meningococci during paired. For those people sampled before and following paired, Table 3 summarizes the details in American and British cross.

Table 3
Carriage of meningococci in children sampled prior to and following Polio vaccination periods

	USA 4/69 221/2800	mean American 1960	peak 1961
Number negative on both occasions	75 (34%)	125 (50%)	111 (42%)
Number positive on both occasions	9 (4%)	23 (9%)	79 (30%)
Number negative pre paired but positive post paired	5 (2%)	11 (4%)	23 (9%)
Number post on pre paired but negative post paired	5 (2%)	14 (6%)	79 (30%)

The number of people requiring strains of *N. meningitidis* is shown, mainly balanced by the number who were positive on the first occasion but negative on return. Of the 19 permanent carriers 21 carried the same group of meningococci throughout and 26 of these were Group 14 whilst of those requiring meningococci during paired 16 strains grouped as B 4 (all in USF Four Squad) grouped as Z 1 grouped as A and 2 were untypable.

Discussion

These studies were suggested by an observed difference in the seroepidemiology of *N. meningitidis* between a Polish military camp who had visited the United States for training in 1944 when a 30 per cent plus positive culture rate was reported, and subsequent surveys in similar camps where only 1.5 per cent positive cultures were obtained. At that

time a 30 per cent isolation rate was considered high in view of the 5.18 per cent isolation rate for a healthy population quoted in a number of sources (Kruskalbaum 1945; Topley and Wilson 1966).

American experience in recent populations indicated that much higher isolation

rates were common (Dwyer et al 1968) and some outbreaks of serotype spread meningitis did occur. In attempts to reduce these outbreaks prophylactic administration of sulphadiazine had been used in US Military populations from the mid 1940s onwards but with the introduction of sulphadiazine resistance strains a number of other agents were investigated for their availability as prophylaxis and treatment (Good et al 1964; Pennington 1968). By 1963 about 12.15 per cent *N. meningitidis* strains isolated from new recruits and 70.95 per cent of strains isolated at the end of initial training were resistant to sulpha drugs (Dwyer et al 1968).

Isolated cases of meningitis strains of *N. meningitidis* were rarely reported in British military populations before 1964 and it was thought that these could provide an indication of the appearance of foreign strains by British personnel visiting the

USA

The main finding of this study is that no detectable difference exists between the serological reaction rates of *N. meningitidis* in British submarine crews and a comparable group of US Navy personnel either before or after the former visited the USA. The lower yield of serogroup 14 strains in British sailors is now considered to be due to serosensitivity in technique in particular the use of more potent media and the delay in primary and test. Using the technique described, which are based on methods refined by the workers of US Navy Medical Research Unit No. 4 at Great Lakes, Illinois (Eisen et al. 1968), these results agree with those found in US Navy Pacific based Pacific submarines (Kays and Clarke 1971). They are similar to figures derived by Fleiss (1971) in a large cross-section of the general population of San Angelo and are rather lower than the 69 per cent of 147 Royal Navy recruits after eight weeks at sea. Kays and Clarke (1971) concluded that underlying infection appeared to have some influence on carrier state, while evidence for this was found in the present studies. It may be significant that the spread found in the relatively small number of post patrol samples taken at the USS Fox Jenkins support this conclusion for a recent trend was found in HMS Ansonian post patrol surveys.

An undesirable pattern emerged from the serological typing of the meningococcal strains isolated as was there any evidence of the suppression of serological serotypes during the visit of HMS Ansonian to the United States. The most common serotype, found in all crews was Group B, which occurred in about 70 per cent isolates.

The findings of an apparent increase in the percentage of capsulated strains isolated during patrol and a particularly high rate since there was no therapeutic or prophylactic use of the drug during these

periods. The authors would like to thank for its post patrol sampling of both crews of HMS Ansonian no unexplained recurrent serotypes were isolated. This is seen at in Fleiss's (1971) findings in East Angles. In both HMS Ansonian and USS Fox Jenkins the incidence of serotype and partially resistant strains was highest on return from patrol and this may be evidence of the subsidence of recurrent forms during the outbreak conditions on patrol.

Acknowledgements

Preparation for this study was given by the Flag Officer Submarines and the Commanding Officer Submarine Squadron 14. One thanks are due to the Commanding Officers medical staff and crews of HMS Ansonian and USS Fox Jenkins for their co-operation.

The work forms part of the studies being sponsored by the Royal Naval Personnel Research Committee of the Medical Research Council into the effects of the varied environment on the crew of nuclear submarines and we are grateful to them and the Medical Director General (Naval) for permission to publish the findings.

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ABSTRACT

ROBERTS, W. J. Anatomical features in Pancreatic Carcinoma of 1961-1965

The paper is a review of the anatomy of the pancreas which bears a close relationship to the pancreas system and the pancreas system with regard to the pancreas system and the pancreas system. The pancreas system is a part of the pancreas system and the pancreas system is a part of the pancreas system. The pancreas system is a part of the pancreas system and the pancreas system is a part of the pancreas system.

Observation was made from a series of cases of pancreatic carcinoma, which were found to be associated with the pancreas system and the pancreas system. The pancreas system is a part of the pancreas system and the pancreas system is a part of the pancreas system. The pancreas system is a part of the pancreas system and the pancreas system is a part of the pancreas system.

When a series of the pancreas system is found to be associated with the pancreas system and the pancreas system, the pancreas system is a part of the pancreas system and the pancreas system is a part of the pancreas system.

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Received 10 June 1968

INHALATION OF THE CROWN OF A TOOTH BY A CONSCIOUS PATIENT

R. Balfour, C. H. A. Kulp, S. G. Jamieson and A. E. J. Smith

ABSTRACT

This communication is presented to:
(a) Stress that inhalation of a foreign body can occur while the patient is conscious.
(b) To illustrate the problems of managing a bronchoscopy patient.

Mr W. was referred to the Dental Clinic, Royal Naval Hospital, Haslemere accompanied by a general dental practitioner who stated that while removing 7/ under local analgesia the crown of this tooth disappeared from view leaving 7/ roots in situ. Apparently the patient was breath holding during the removal, being then released. After a careful search of the surroundings the practitioners had chest X-rays carried out. These revealed the crown lying in the right bronchus (Fig. 1).



Fig. 1. Chest X-ray, R. Lung.

The patient was apprehensive, but had no cough or dyspnoea. There was no cyanosis, tachycardia or tachypnoea but an allergy to Penicillin necessitated Tetracycline therapy and their surgery.

A combined ENT/Dental operation was performed the same evening, at induction and 7/ roots were extracted following removal of the tooth crown by bronchoscopy under general anaesthesia. The latter procedure was difficult as the crown was larger than the lumen of the bronchoscope, but it was accomplished skillfully by careful withdrawal of tooth crown, for tips and bronchoscope together.

A basic principle in emergency bronchoscopy for foreign body removal is that it should be carried out as soon as possible after the accident, and certainly before any local reactions such as oedema, spasm and discharge the view.

Numerous investigations, only by us, with the bronchoscope foreign bodies are available but despite this change, none may be found which will indicate such a large, irregularly shaped foreign body, such as the one described in this presentation, which had the additional complication of a hard smooth and very slippery surface.

Anaesthetic Technique

After normal premedication and after secure induction the patient was maintained for the period of the bronchoscopy in a state of preconsciousness and complete muscular relaxation by succinylcholine, 1 mg of Thiopentone (100 mg/ml) and Nembutal (25 mg/ml) total as appropriate amounts. During this period artificial ventilation was required, and to achieve this a Volume method was employed. The apparatus is described in Fig. 2.

It consists of a thin tube which clips on to the bronchoscope, and which is supplied with oxygen from the pipes.

ASSAY OF STRONTIUM-90 IN HUMAN PERMANENT TEETH IN THE UNITED KINGDOM 1966-1971

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ABSTRACT

A survey of the accumulation of ^{90}Sr in human teeth has been carried out by the Royal Navy. It covers the 12 years 1959-71 in which fallout levels rose to a peak and declined again. Correlations have been established between the uptake of ^{90}Sr in developing teeth and bone, related to fluctuating rates of $^{90}\text{Sr}/\text{Ca}$ in the diet. Since mineral rates are permanently fixed in teeth by irreversible deposition they constitute an inflexible record of the levels of bone-seeking elements (including contaminants) that existed when the teeth were being laid down. Thus it becomes possible to estimate former bone rates prevailing in the teeth, so that how much prevailing levels of contamination may have changed in the meantime. The present study provides present parameters whereby the map is done.

This report, the last of the series, presents further results of assays of strontium-90 in permanent teeth measured during the years 1966-1971. It concludes the survey, set up by the Royal Navy in conjunction with the United Kingdom Atomic Energy Authority of strontium-90 accumulating in the dental tissues of man as a result of radioactive fallout (Table 1). Corresponding tables covering the period 1959-1965 have been published previously (Rogers Henderson and Hoag 1965; Barclay Bryant and Henderson, 1966; Barclay Goodridge, Fletcher and Brooks 1967).

Material for assay is collected from 11 parts of the country by 72 associates. The sampling programme has remained unchanged as first laid down by Hoag in 1959. This has led to an unusually long run of strictly comparable results. The teeth are required to be whole and sound (ideally in digestion over-extended) growth patterns laid down under changing conditions of nuclear contamination. Therefore the survey has been limited to persons from periods 9-15 years old and third molars from periods 1942-1951, and gives the very consistently extended in perfect condition for orthodontic reasons. Two collections are made each year in January and July. Samples are bulked according to age group. Crowns and roots are divided and analysed separately and whole tooth values derived by calculating the weighted means.

The analytical methods follow those of Bryant, Hoag and Spurr (1959) made first for teeth as described by Bryant *et al.* (1960) and Barclay *et al.* (1965). Counts are made here from cleaned rifling to more than 16,000 teeth. Assays of third molars were discontinued after 1964.

In general the strontium-90 burden in a developing tooth is related to the amount of fallout. Nevertheless since the teeth erupt at different times concentrations vary with the age of the child, with different teeth in the same child, as well as in different parts of the same tooth according to the levels of nuclear yield prevailing during calcification. The amount of teeth develop before the roots. When a tooth

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Table 1
Details of samples and results of analyses of human teeth No. 154-175
 (Nile Valley, 1946/47, Egyptian)

No. of Sample tooth	Date of burial	Age Estimated	CARBON		ADDITION		WHOLE TOOTH	
			% C _{org} C _{tot}	% pH ₂ O C _{tot}	% p ₂ O ₅ C _{tot}	% pH ₂ O C _{tot}	% p ₂ O ₅ C _{tot}	% pH ₂ O C _{tot}
154	407	8	2.26	1.8	2.26	1.9	2.26	2.1
155	407	10	2.26	1.4	2.26	1.9	2.26	2.1
156	407	11	2.26	1.1	2.26	1.9	2.26	2.1
157	407	12	2.26	0.8	2.26	1.9	2.26	2.1
158	407	13	2.26	0.5	2.26	1.9	2.26	2.1
159	407	14	2.26	0.2	2.26	1.9	2.26	2.1
160	407	15	2.26	0.0	2.26	1.9	2.26	2.1
161	407	16	2.26	0.0	2.26	1.9	2.26	2.1
162	407	17	2.26	0.0	2.26	1.9	2.26	2.1
163	407	18	2.26	0.0	2.26	1.9	2.26	2.1
164	407	19	2.26	0.0	2.26	1.9	2.26	2.1
165	407	20	2.26	0.0	2.26	1.9	2.26	2.1
166	407	21	2.26	0.0	2.26	1.9	2.26	2.1
167	407	22	2.26	0.0	2.26	1.9	2.26	2.1
168	407	23	2.26	0.0	2.26	1.9	2.26	2.1
169	407	24	2.26	0.0	2.26	1.9	2.26	2.1
170	407	25	2.26	0.0	2.26	1.9	2.26	2.1
171	407	26	2.26	0.0	2.26	1.9	2.26	2.1
172	407	27	2.26	0.0	2.26	1.9	2.26	2.1
173	407	28	2.26	0.0	2.26	1.9	2.26	2.1
174	407	29	2.26	0.0	2.26	1.9	2.26	2.1
175	407	30	2.26	0.0	2.26	1.9	2.26	2.1
176	407	31	2.26	0.0	2.26	1.9	2.26	2.1
177	407	32	2.26	0.0	2.26	1.9	2.26	2.1
178	407	33	2.26	0.0	2.26	1.9	2.26	2.1
179	407	34	2.26	0.0	2.26	1.9	2.26	2.1
180	407	35	2.26	0.0	2.26	1.9	2.26	2.1
181	407	36	2.26	0.0	2.26	1.9	2.26	2.1
182	407	37	2.26	0.0	2.26	1.9	2.26	2.1
183	407	38	2.26	0.0	2.26	1.9	2.26	2.1
184	407	39	2.26	0.0	2.26	1.9	2.26	2.1
185	407	40	2.26	0.0	2.26	1.9	2.26	2.1
186	407	41	2.26	0.0	2.26	1.9	2.26	2.1
187	407	42	2.26	0.0	2.26	1.9	2.26	2.1
188	407	43	2.26	0.0	2.26	1.9	2.26	2.1
189	407	44	2.26	0.0	2.26	1.9	2.26	2.1
190	407	45	2.26	0.0	2.26	1.9	2.26	2.1
191	407	46	2.26	0.0	2.26	1.9	2.26	2.1
192	407	47	2.26	0.0	2.26	1.9	2.26	2.1
193	407	48	2.26	0.0	2.26	1.9	2.26	2.1
194	407	49	2.26	0.0	2.26	1.9	2.26	2.1
195	407	50	2.26	0.0	2.26	1.9	2.26	2.1
196	407	51	2.26	0.0	2.26	1.9	2.26	2.1
197	407	52	2.26	0.0	2.26	1.9	2.26	2.1
198	407	53	2.26	0.0	2.26	1.9	2.26	2.1
199	407	54	2.26	0.0	2.26	1.9	2.26	2.1
200	407	55	2.26	0.0	2.26	1.9	2.26	2.1
201	407	56	2.26	0.0	2.26	1.9	2.26	2.1
202	407	57	2.26	0.0	2.26	1.9	2.26	2.1
203	407	58	2.26	0.0	2.26	1.9	2.26	2.1
204	407	59	2.26	0.0	2.26	1.9	2.26	2.1
205	407	60	2.26	0.0	2.26	1.9	2.26	2.1
206	407	61	2.26	0.0	2.26	1.9	2.26	2.1
207	407	62	2.26	0.0	2.26	1.9	2.26	2.1
208	407	63	2.26	0.0	2.26	1.9	2.26	2.1
209	407	64	2.26	0.0	2.26	1.9	2.26	2.1
210	407	65	2.26	0.0	2.26	1.9	2.26	2.1
211	407	66	2.26	0.0	2.26	1.9	2.26	2.1
212	407	67	2.26	0.0	2.26	1.9	2.26	2.1
213	407	68	2.26	0.0	2.26	1.9	2.26	2.1
214	407	69	2.26	0.0	2.26	1.9	2.26	2.1
215	407	70	2.26	0.0	2.26	1.9	2.26	2.1
216	407	71	2.26	0.0	2.26	1.9	2.26	2.1
217	407	72	2.26	0.0	2.26	1.9	2.26	2.1
218	407	73	2.26	0.0	2.26	1.9	2.26	2.1
219	407	74	2.26	0.0	2.26	1.9	2.26	2.1
220	407	75	2.26	0.0	2.26	1.9	2.26	2.1
221	407	76	2.26	0.0	2.26	1.9	2.26	2.1
222	407	77	2.26	0.0	2.26	1.9	2.26	2.1
223	407	78	2.26	0.0	2.26	1.9	2.26	2.1
224	407	79	2.26	0.0	2.26	1.9	2.26	2.1
225	407	80	2.26	0.0	2.26	1.9	2.26	2.1
226	407	81	2.26	0.0	2.26	1.9	2.26	2.1
227	407	82	2.26	0.0	2.26	1.9	2.26	2.1
228	407	83	2.26	0.0	2.26	1.9	2.26	2.1
229	407	84	2.26	0.0	2.26	1.9	2.26	2.1
230	407	85	2.26	0.0	2.26	1.9	2.26	2.1
231	407	86	2.26	0.0	2.26	1.9	2.26	2.1
232	407	87	2.26	0.0	2.26	1.9	2.26	2.1
233	407	88	2.26	0.0	2.26	1.9	2.26	2.1
234	407	89	2.26	0.0	2.26	1.9	2.26	2.1
235	407	90	2.26	0.0	2.26	1.9	2.26	2.1
236	407	91	2.26	0.0	2.26	1.9	2.26	2.1
237	407	92	2.26	0.0	2.26	1.9	2.26	2.1
238	407	93	2.26	0.0	2.26	1.9	2.26	2.1
239	407	94	2.26	0.0	2.26	1.9	2.26	2.1
240	407	95	2.26	0.0	2.26	1.9	2.26	2.1
241	407	96	2.26	0.0	2.26	1.9	2.26	2.1
242	407	97	2.26	0.0	2.26	1.9	2.26	2.1
243	407	98	2.26	0.0	2.26	1.9	2.26	2.1
244	407	99	2.26	0.0	2.26	1.9	2.26	2.1
245	407	100	2.26	0.0	2.26	1.9	2.26	2.1

erupts into the mouth a precisely constant rate and the crown develops afterwards. Since the roots therefore are the latest portion of the tooth to erupt they reflect the latest conditions prior to completion while the crowns reflect the earlier levels that existed when they (the crowns) were overgrowing themselves. Thus a fall-out gradient for intake, a two or full or the level of strontium-90 in the dent may be collected in a single tooth.

Up to 1966 the uptake of strontium-90 remained just by year and, in any particular year it was inversely related to the age of the denton. What is to say the later the tooth was to erupt the more they were affected by the increasing nuclear yield. In older groups a considerable bulk of teeth had formed prior to 1963 before the atmosphere had been severely polluted in all directions external burdens were low especially in the crowns. While both root and crown values increased up to 1966 the roots were always high even paired with the corresponding crowns. On average, there seems to be a time lag of about four years between the two.

When the decay level of strontium-90 started to go down the distribution was reversed. Between 1966 and the end of 1971 intake levels were falling the following trends started up for the first time: (1) crown values fell away towards the 1966 peak, and (2) root values beginning to fall away from the 1966 peak. In consequence, crown/root ratios for 8 year old groups crossed over in 1969 for 16 and 15 year-old groups in 1969 and for 13 and 11 year old groups in 1970. Meanwhile the lower crown relationship with age began to flatten and by 1971 the 16/15's ratios were more or less even in all age groups.

Conclusions

Increasing conclusions have emerged from the uptake of strontium-90 in developing tooth and in developing bone.

Since bone-seeking elements, including strontium-90 are fixed in teeth by irreversible deposition tooth ratios reflect original ratios that pertained in the situation at the time the tooth were being laid down. In other words the teeth are living fossils. They make it possible to deduce former ratios in bone even though the level of trace elements may have altered with the passage of time. The present study provides broad parameters whereby this can be done. For example, direct comparisons between premolars root values for 16- and 15-year old groups (1960-1970), and URADA, post-dentition bone ratios for persons aged 5-19 (1963-1970) can be seen in Table 2. While the bone ratios show somewhat greater variation in changing nuclear yields the underlying relationship is unmistakable. At present, the 5-19 year age group for bone is rather too widely spread to provide tooth/bone coefficients of high precision, but it is hoped as the new bones in future sharper conclusions by comparing the individual bone values into dentition levels.

Table 2

Comparisons of 16/15 (URADA) in tooth and bone,
(1) Post-dentition bone: age groups 1-19 years
(2) Dentition roots: age groups 16 and 15 years

	Ratio		
	Age 5-17	Age 16	Age 15
1964	0.77	—	—
1965	0.76	—	—
1966	1.15	0.60	0.66
1967	1.07	0.77	0.91
1968	1.17	0.80	1.01
1969	0.95	0.70	0.78
1970	1.20	0.80	1.10
1971	1.70	1.00	1.00
1972	2.60	2.00	2.00
1973	2.10	2.00	2.10
1974	1.80	1.80	1.80
1975	1.60	1.50	1.60
1976	1.60	1.50	1.60
1977	—	1.50	1.50

Meanwhile, the remarkable intercalculation embedded in the premises apply to all other tooth categories subjected under similar circumstances, now or later. This is corroborated by the 3rd value table published in previous reports (Bachay *et al*, 1984, 1986). Natural attrition for the year 1985 of different teeth from persons of different ages are given in Table 3.

Table 3

Percent of natural attrition, represented by analysis of teeth from persons of various ages in 1985

TOOTH Category	Age 15	Age 20	Age 35
Incisors	19.64-19.71	19.56-19.64	19.59-19.58
Canines	19.63-19.70	19.55-19.63	19.58-19.61
1st Molars	19.60-19.67	19.59-19.65	19.60-19.61

Because the survey has encompassed the full 11-12 year growth period of the human permanent teeth during a complete cycle of infant transition it has been possible to monitor the uptake and eliminate use of restorative stents or stents on a scale that could never have been envisaged representatively. Apart from innovations of denture this is a relevant public health factor at a time when the marketing problems of artificial white a-glass cases

for denture, in the vicinity of Acromioclavicular (AC) tooth/teeth ratios are steadily being used to estimate denture levels of lead.

Acknowledgements

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LOMOXIL — A DANGEROUS DRUG

A. R. Shank and P. Lammiman

ABSTRACT

The case histories of two children of an army family aged two and five years old, who were admitted to the Royal Naval Hospital, Gibraltar, after an overdose of Lomoxil, is presented.

Introduction

Lomoxil (hydroxytolene hydrochloride 25 mg and naxoprine sulphate 0.25 mg) has been available for more than ten years and is an effective agent in controlling diarrhoea by reducing intestinal motility (Dawson and Johnson, 1962). It is now a widely prescribed preparation for both acute and chronic diarrhea. Side effects usually consist of weakness, depression and vertigo have long, noted for some time (Johnson and Johnson, 1962; Cohen, 1964) and the B.M.J. in a leading article has warned Lomoxil users of these in potent children (B.M.J. 1970). The danger of depression and its prompt response to Naloxophane was stressed.

Case Reports

Case 1: The two year old son of a/c 12875 was admitted on the afternoon of November 25, 1973 as a convulsing child. He had his five year old sister had been left alone for a period during the morning. He usually took a sleep around lunch time and his father did not think that anything was wrong until he noticed that there was vomit to the side of his younger child and that he was unresponsive. A bottle of Lomoxil was found nearby. The exact time of taking the tablets and the dosage taken could not be ascertained. Both persons stated that the drug had not been prescribed for any member of the family and the cap of the bottle of Lomoxil

was not known.

On arrival at hospital he was promptly intubated with an endotracheal tube and intubated oral Guedel Airway was performed with a good return of consciousness. Following intubation he recovered consciousness and the endotracheal tube was removed. He lapsed into coma again after a few minutes. However usually spontaneous respiration was regular at 24/min and he was not cyanosed. At this point the heart rate was 140/min and BP 100/70. Pupils were noted to be small and did not react to light. There was bilateral decerebrate. This preceded complete apnoea and cyanosis which responded dramatically and instantaneously to an intravenous injection of Naloxophane 2.5 mg.

The figure shows the response of events



The second episode followed a small vomit when consciousness and clear state of awareness was regained. Once more a prompt response to Naloxophane was observed. A further dose of Naloxophane was considered desirable to cover rate

breath. This produced a tachypnoea which persisted for three hours. Over this whole period heart rate and BP remained unchanged.

The following supportive measures were also instituted. Dextrose 50% was at the rate of 1000 ml/kg. 24 hours was given intravenously and Ascorbic 125 mg at hourly rate given as a prophylactic against respiratory infection following the unobstructed intubation of voice. He was unconscious and responded only to painful stimuli for 12 hours following admission and then regained consciousness but could lie for 24 hours longer. Latent oral fluids were given over the period and occasional vomiting occurred.

Thirty six hours after being brought into hospital he was fully alert and alert. Physical examination revealed no abnormality, and chest X ray showed clear lung fields. Recovery has since been unremarkable.

Mother told that sister had vomited in particular following the consumption of Leonard. She said that she had only had one toilet but for a questionable 15, was admitted seven hours after her brother for observation. There was no disturbance of consciousness or respiration and physical examination was entirely normal. No further vomiting occurred and she was discharged home.

Discussion

The two cases reported showed severe and mild consequences of diphthero-epitax overdose.

In the case of the younger child severe

respiratory depression, small conjugate pupils and abdominal distension were clinical features of massive overdose of this drug.

The 1944 (London, 1971) reviewed the 18 reported cases of either accidental or purposeful large doses or wrongly prescribed medicines in children. Two cases died and in others the response to Molar plasma was prompt. The latter appears to have a specific antagonistic effect to diphthero-epitax.

The predominant feature of the two year old reported here was the variable level of consciousness and the sudden epistaxis which occurred.

Leonard is a dangerous drug when children are concerned. It is prescribed freely and the onset of warning of its danger to children lies with the prescribing doctor.

Overdose should be treated promptly with gastric lavage and close observation of any child showing any disturbance of consciousness or respiratory depression a mandatory Polyphosph should be immediately available in all cases and ought to be administered at the first sign of depression or respiratory.

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ADrift IN THE PACIFIC

A personal communication

Maxwell Bailey

The last issue of *Pacific Medicine* and the *Rural Medical Society, Equipment and Survival* Journal were recently published in time to reach the life and Mrs. Bailey who were still recovering from the effects of their shipwreck in the Pacific Ocean followed by 100 days survival in a rather bleak.

After discussion on the problem they had they were an abnormal fall of the business decision, in greater detail the physical and mental effects of their ordeal. They printed a most fascinating fall, and Maxwell Bailey was finally offered a whole short paper for the Journal so that a wide circle of readers could share their experience.

We are extremely grateful for the opportunity to publish such a unique paper which will be greatly appreciated by all readers. This was an ordeal life and Mrs. Bailey, copied with their disaster and the extent to which they have recovered can be judged from Fig. 1—a photograph taken in a different rubber display. Below.



Fig. 1

Falls, Hawaii

Mrs. Maxwell Bailey, Surgeon Captain W. A. H. Bailey, M.D., Bailey, and Dr. A. H. Bailey, Commander U. S. Navy

Afterward work from night and week for group, came the shock of realizing that our world had changed. We had automatically exchanged our outside team for the inside. In safety of an intimate life with Maxwell and I were adrift on a ocean covering our head of the earth's surface. We had escaped from our sailing yacht with a radio apparatus and we now began to adjust to our inside surroundings.

And so began four months of living in isolation on the sea. Five months spent overcoming the problems of staying sane from the sea. We found everything else from what we had come to accept as our natural environment. Somehow we had to adjust physically and mentally to the knowledge that only our own resources would now keep us alive. We could rely on our outside resources.

After our initial thoughts about our chances of survival there came a disappointment to find, assuming from a desire to remain sane and to talk rationally. From our discussions we realized a plain honest desperate the prospects to start again and with time to find our way home. We found a definite need to plan ahead and our discussions covered our biggest fears. Eventually our plans became sound, they were more than a mere fantasy. We reached such a path of confidence that our plans became real and we discussed a purpose to live. Death however, there could never intrude while we were able to discuss the possibility of a new advent here.

A time came eventually when it was only with colored determination were we able to keep our conversation on a subject that kept. However, expressed we became

5



Fig 2

rubber survival craft

ing, leaving our communication world wandering on to its subject's bed. We missed the simple, prepared dishes, things that we had when we were in the greatest proximity.

As the days stretched into weeks and the weeks into months it seemed to us as though everything was against us. To begin with we discovered that we had left the essential life boats and lost out of our emergency pack. Then our plans to reach safety were foiled by the winds and our rats. The rubber survival craft was purchased after 30 days. Finally things lifted as we saw desperate signals.

Our minds gradually accepted that these days would not see us and were becoming an extension into our lives. They disturbed our peace and their passing left us in line

upside. The ice, unpleasant here that while, a proving they usually regarded hope as placed into, released us being seen.

We had to reach safety ourselves. Perhaps our interest can be better related to our attempts to reach safety and would therefore, be devoted into these distant places. The first brief phase consisted of an extensive attempt to row to the Gullspage Islands, a point where we had little food and water. The second phase followed much only when food and water became plentiful and we added a very real to reach the emergency commercial corner current, north of us. This current, we hoped, would be the means of reaching the North American continent. After this struggle through the extensive field

times we were met by a well-organized current and were driven out into the waters of the Pacific. The third phase became a period of growing recognition with the last stage of survival being the possibility of being seen when we encountered the shipping lanes connecting North and South America.

We were indeed fortunate that the area in which we were sailing was an area tropical convergence zone which naturally contained a wide variety of animal life. Our thoughts would sometimes dwell on the possibility that one day our birds might take us out of this area of plenty into a desert area. If this had happened, how could we have been sure that we could have faced the ordeal with the same determination?

Nevertheless, our time in the sea became a time of new experiences, the suffering apart. We found ourselves so close to the sea that we became part of the sea, actually living in its currents. Although we were competing with other animals of the sea in order to live, we found them very respectable creatures, and they helped to relieve the dependency of our mechanistic solution.

There was a unique and privileged situation. We watched animal, fish and bird life, all fascinating and unified, all very close together. Creatures moved on currents and just so we, with only our experience of the world of animal man, in a yardstick, a wasp's eye. Everything happened naturally. There was a sense of mystery which gave us a satisfying feeling that everything was all right with the world after all.

Previously, before our trip, we had considered ourselves advocates of wild life conservation campaigns. Even then, when ultimate survival seemed remote, we did think intensely of the business of slaughtering these beautiful creatures. We felt no major awe towards the whale that had suddenly made our world so small — only pity. We asked the captain if whale meat

was and we long for some international understanding on their preservation.

I think the wild life of the world is a very precious part of man's heritage and we must stop growing quick polytechnics and stop slaughtering natural birds and fish as "good" or "bad." We must take our share of the burden of understanding and preserving wild life. Man, at a very great value, is later born at present that way, a level and emotional person. But will enable us to preserve our contrasting environment.

We noticed that one part of the come was possible in wild life. Hundreds of eagles, tiger fish, waterbirds, spurs, trout, immense dorado and many other species did and existed in a beautiful building and business where in the clear blue water below us. As though in some way the state animal kingdom exists, the sharks did not play a seriously.

Male turtles, professors in appearance were mysteriously attracted to our raft to be drawn by their attraction of our new computers probably. They would appear at any time, day or night, showing absolutely no fear of us at all.

Many birds would keep on company each day, demanding points (only birds of the sea) provided legs and above bodies. When of the open water and dolphins swam close to boats, each one individually fascinating and sometimes to our tormented nerves, stirring.

During the last months that we were with us, observed the same dedication was constantly from our depths North through the Equator to 25 degrees North to the Tropics of Cancer. The order moved with the cloudy whale and the day displaying almost as a repeated pattern: a mass of bright flathead concrete clouds. The sun gave way to the grey contrast shade of the Dolphins with its movement run making one flow watched and turning our existence into an episode of hell.

Three months later, with all hope of reaching safety by ourselves gone and only a slim chance left for our survival the storm cleared, giving an uplift to our morale. We welcomed the first break in the cloud, revealing the narrow scintillating gleam of the blue sky. Thankfully we opened our shelter to expose us to the scorching warmth of the sun. The sun, a complex shining orb, appeared from behind a cloud and seemed to signal that there was a new beginning. A reason for renewed hope.

Perhaps I lost day in all truth that Marjorie and I had been living in the confined space of a small boat for several years and this had added to us our first steps for survival. Our attitude of mind was proved negatively for the reactions of each other. When one believed the other gave counterproof.

Yet it was Marjorie who inspired survival she possessed a positive attitude to dependency. It was as though she wit-

nessed the challenge, finding an active way of maintaining life and the will to live. Her need to separate the 'known' with only despair to arrive sooner in a small place, told she was always opposed. Her spells of depression were short and she seemed to give her best when conditions took a turn for the worse. She inspired me from an extraordinary courage and I can now without his abhorred confidence I would have lost the will to live.

Marjorie kept a diary day by day. Her notes became a faithful account of our survival, describing details of the events as they affected us of both food and mental behaviour, of the high points and low points of our physical and mental health. Yet the days merged one with another and made no impact on our minds. As the days went by it seemed as though we had no other life. It was life, pain and breath measured in simple terms of an hour would consist of staying alive.

admission to Members of the Royal Society, the time never lags, owing to that one has shared little part in the making of a career which, happily, exemplifies the professional one of the members. Here the two goals to meet the requirements of great commitment are not only done, but are usually done. It was characteristic of his determination to meet every challenge that even in his retirement as President World Affairs, a Mission for England as a British ambassador, several are completely fulfilled and by this distinguished equity by logical steps. Director of Plans, Assistant Chief of defence staff, Vice Admiral Second-in-Command, Sea Lord West, Vice Chief of Naval Staff, and in 1971, the first Vice-Chairman in Chief of the whole Fleet, before taking up the present appointment in the Navy.

For the last long, which has no doubt are, entitled to be remembered as a recipient by a Christian society which accounts its credit comes not by a humanity which is clearly more the value of love. With the Royal Navy in such hands, we can have the finest work available.

Member of the Royal Navy Medical Club, I give you the best of my wishes.

Admiral Sir Edward Ashmore, CBE, DSO, DFC, DSC, Chief of the Naval Staff and Vice Sea Lord, received on behalf of the group.

Mr President, Chairman, my fellow friends, I say very much to appear by receiving you for your boundary line today, and as such you have made me not suppose the splendid thing on your magnificent surroundings — in the buildings of Westminster and here the other day — Africa the last thing of my last day into the future. Good. So we have three years, we have enough to reveal here that a year back and as a Temple left as a hospital.

We have got behind to a new beginning and encouraging success from Admiral West and a completely new Chairman (that the Medical Society of the Royal Navy is being more effectively provided by the hand of various personnel by the Marine General, who, that his duties are, however, I fully accept that some responsibilities should be passed on to the navy).

First, thank it is a very healthy state and is showing in our work with significant success as a team of great change. Admiral West has made our progress and achievement. It is to thank the Staff of Westminster who, it is true, have a more less successful and otherwise the change, as when you are on longer stand it. But I think we should have been able to do any action of some of your pleasure had we developed education, comprehensive rights. But there are other changes. The results of the medical system displayed in support of the Royal Naval Commanders in comprehensive operations a number of members. This is the role of these responsibilities in Medical Services. From more that many of them should be provided by the Maritime Society, but it should also mean the progress of some a number of members held in the Institute of Naval Medicine at Alexandria which are already done.

And be representative from the point of personnel with the medical community and the of all problems of the world, the very rapid progress that you believe necessary in the present day of our time, medicine will be particularly valuable and I am sure, really for the progress.

The issues in which our naval hospitals are now engaged in some time further, and as well as the medical community of people, which the service is important and whether the opinion of the bodies and between the operations of the National Health Service and private practice, it seems certain, so we that they will be greatly used in the future for the Medical Service of Hospital and further in the future in the same way that they always have worked.

While on the subject of change however, I think it is fair to say that you in the present most successful have obtained by the different approach change exactly that the Defence, there are however should not be interrupted.

Furthermore, while considering that the naval doctors and dental services used to be a part of the navy and were not separate, capable of contributing to fields far removed from those concerned by the navy or with any degree connected to them and responsibilities were, however, we still are less right of the fact that the great value of the Navy Medical Service is more and contribution of medical care in the last the health and welfare of all sorts of the community that we cannot who were naval sailors.

Like the rest of medicine, the Naval Navy was once founded — not here by King Edward I, but it was not as required for the field to protect our maritime interests and to provide those of all people the history in the field of our life as a nation, as it developed from a fleet of ships that they standing as men and as maritime interests, and a number of resources today, a number for supporting and supporting the naval service and there is a project in the new field (developing the model is in an even two projects of the independent organization called the power, which has proved proved the very important action taken and before the date of the future part with the new formation from Cairo.

Nevertheless we are the future, maritime power in some sense considerably different that happens through the sea and in the future, it is well as in the future, that the power in the future is under the of the sea for political and military purposes, the programme by which, which have appeared maritime facilities, but as yet, the ability in modern resources and to make the completed study of that maritime power, maritime power, is important in the life, because we are a densely populated, and will have the power and it is only only even with the military. Maritime medicine is a very important branch, but it is valuable to military in the present through in the past 50 years, which we have generally been in a few times, many changes are in record.

The second element of the future power is that to protect the maritime interests, it is not the

[illegible]

However, since only the Soviet Union is made more technologically and militarily than they are, it is not clear that the rest of the appropriate national characteristics of our national identity. It is clear, however, that the Soviet Union is not a national identity of our national identity. It is clear that the Soviet Union is not a national identity of our national identity. It is clear that the Soviet Union is not a national identity of our national identity.

In the United Kingdom it is their tradition before signing of a document that they come to hand an agreement to maintain the law of the land, particularly in the Attorney General and the Justice of the Peace.

[illegible]

As far as I am concerned, I am determined that the Negro within America has to go the same old-fashioned way, and no special speed is required. We have no interests of business along with the Negro. I have had the same principle in a resolution I brought in regarding the use of this language both in the House, in a resolution.

Furthermore, I believe that in order to ensure that our moral philosophy, or conception of an ideal society, is not "too close to the starting line" and in order to begin after our technological measures fade, we shall be the responsible future leaders of a just and caring society and as a society, maintain long-range fairness. Thus, I am convinced that the responsibility to be morally developed by a kind of moral maturity will reflect in the

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[illegible]

When does your mother stop worrying? (asked by the reporter) Well, it seems to have stopped the day my mother died. It's strange, and that's the problem here. *Myself*. Except... The fact of it... Royal Navy is to send in over a week... something with a view to well understood... it may be that much understood... Chicago... If you have had it at any random point, the statement of the capital... before of you... well, I am sure that it will which may be... which goes to the... in the Royal... Naval College in Greenwich... It is, even... Royal... the... of... the... already... (asked by the reporter)

During my 10th Anniversary Party, I shared the fact that all your people are also working and the year long delay I am sure we all had from last

Abstract

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Michigan University (1969) and the
 State of Michigan (1970) and was placed on the national list of
 "Outstanding Universities" in August 1, 1970.

Figure 1 consists of a 3x3 grid of bar charts. Each chart has a y-axis labeled 'Percentage' ranging from 0 to 100. The x-axis for each chart has three categories: 'All respondents', 'Non-respondents', and 'Respondents who did not answer'. The bars are colored blue, red, and green respectively. The data is as follows:

Category	All respondents (%)	Non-respondents (%)	Respondents who did not answer (%)
All respondents	100	0	0
Non-respondents	0	100	0
Respondents who did not answer	0	0	100

[illegible]

After Krimm, who presided as elected chairman last 1/2, passed out the spirit of his party with confidence and grace throughout the evening, he accepted a large bouquet on the left of good cheer, enthusiasm and good will from a friend and the two

TRANSFERRING

To Surgeon Lieutenant-Commander A. P. Steele-Pedley M. J. Stoddart M. C. Lightfoot G. Smith M. A. McDonald M. H. Miles D. J. Pryor, R. F. Day, T. C. Woods P. V. Oyston

To Surgeon Lieutenant-Commander (MB) M. G. Dixon M. M. Dr. Roberts

To Surgeon Lieutenant D. J. Phipps P. J. Stoddart M. H. Richardson P. J. H. Tait, J. G. Tait D. H. West J. W. Ayton R. F. H. Tait

To Surgeon Lieutenant (MB) M. J. O'Neill J. R. S. Roberts

To Acting Surgeon Lieutenant T. R. D. Riley G. A. H. Miles, R. C. Adams P. C. Macdonald R. J. Wells M. J. Hall

TRANSFERRING

Permanent transfers to June 1955: To Surgeon Captain D. L. Winkley M. J. (Capt) L. B. Lawrence-Dunn, R. J. W. Lambert

To Surgeon Lieutenant J. M. Baker M. A. Macdonald R. W. Miles

To Surgeon-Commander (MB) D. A. Lapham G. H. H. H.

NEW ENLISTED

Surgeon Lieutenant G. M. Kyle Secretary R. Smith

Surgeon Lieutenant (MB) W. J. West J. F. Harkins

Surgeon Sub-Lieutenant R. W. Miles M. C. Phipps M. H. Miles, J. Winkley

Surgeon C. J. Macdonald P. C. Oyston C. L. Oyston R. V. Winkley C. H. Miles A. D. Smith C. J. Phipps A. J. H. Macdonald R. Kelly

TRANSFERRED TO THE PENINSULAR COMMAND

Surgeon Lieutenant R. J. Lambert M. C. Smith

TRANSFERRED TO PERMANENT COMMITMENT

Surgeon Lieutenant-Commander P. T. Day P. H. Macdonald

Surgeon Lieutenant G. L. Pryor

REMOVED ON COMPLETION OF SHORT SERVICE COMMITMENT

Surgeon Lieutenant-Commander P. C. Harkins R. J. Lambert M. H. Miles

Surgeon Lieutenant-Commander (MB) J. M. A. Phipps R. A. Phipps, A. P. Phipps

Surgeon Lieutenant (MB) J. M. Oyston P. J. Day, P. A. Oyston J. A. Oyston G. W. Macdonald P. L. Oyston D. P. A. Oyston N. C. Oyston

Surgeon Lieutenant (MB) A. J. Harkins M. C. Harkins

RETIRED

Surgeon Rear Admiral (MB) J. Harkins (MB) Harkins

Surgeon Captain J. M. Harkins (MB) R. J. Macdonald (MB) R. H. Richardson

Surgeon Captain (MB) R. H. Richardson P. L. Harkins (MB)

Surgeon-Commander R. H. Harkins

Surgeon-Commander (MB) R. H. Harkins M. J. Oyston

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Surgeon-Commander (MB) W. J. Harkins

Surgeon-Commander in the Medical Service Section of the Medical Section

Formation

To Surgeon-Commander (MB) M. C. Oyston A. J. Harkins

To Surgeon-Commander (MB) M. F. Harkins M. C. Oyston

To Surgeon-Commander (MB) J. H. Harkins G. Harkins

QUEEN'S MEDICAL SERVICE MEDICAL SERVICE

Section

Section 1, Queen's Medical Service—MBSC

New Enlistment

Surgeon M. A. C. Harkins P. L. Oyston D. H. Oyston J. M. Harkins J. F. Harkins R. H. Harkins

Surgeon M. A. C. Harkins J. L. Oyston J. C. Oyston P. L. Oyston R. Harkins R. J. Harkins

Formation

To Surgeon-Commander (MB) M. C. Oyston J. L. Oyston

Transferred to Permanent List

Surgeon M. A. Harkins M. C. Oyston J. L. Oyston

Recesses

Mr. A. A. J. was absent, having been called
away to the
Mr. B. D. J. was absent, having been called
away to the
Mr. C. D. J. was absent, having been called
away to the
Mr. F. J. was absent, having been called
away to the

ROYAL NAVY, SENIOR

Recesses

To Surgeon General, A. H. J.
To Surgeon General, J. H. J.
To Surgeon General, J. H. J.

Recesses

Surgeon General, J. H. J.
Surgeon General, J. H. J.
Medical Superintendent of King Edward VII
Hospital, J. H. J.
Lieut. Colonel, J. H. J.
Lieut. Colonel, J. H. J.
Lieut. Colonel, J. H. J.
Lieut. Colonel, J. H. J.



AUTHORS

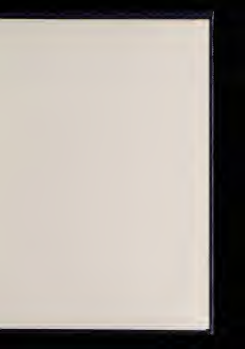
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